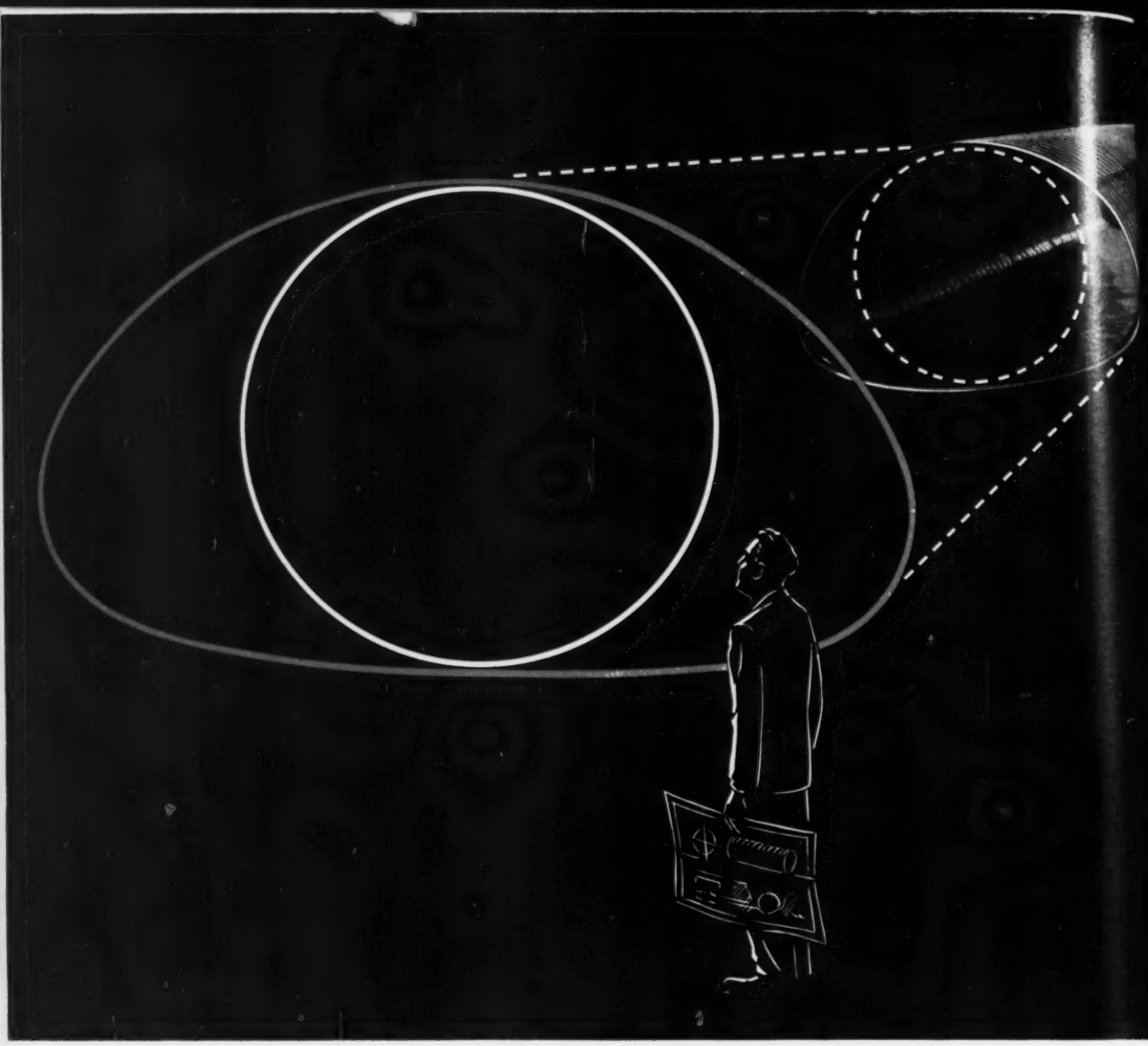
ENGINEERING NEWS-RECORD

A McGRAW-HILL PUBLICATION

APRIL 1, 1948

Y STEP—Construction
head on Ross Dam,
the third lift is being
to raise the height
structure to 540 ft. A
stage will bring the
eight to 675 ft.



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April 1, 1948

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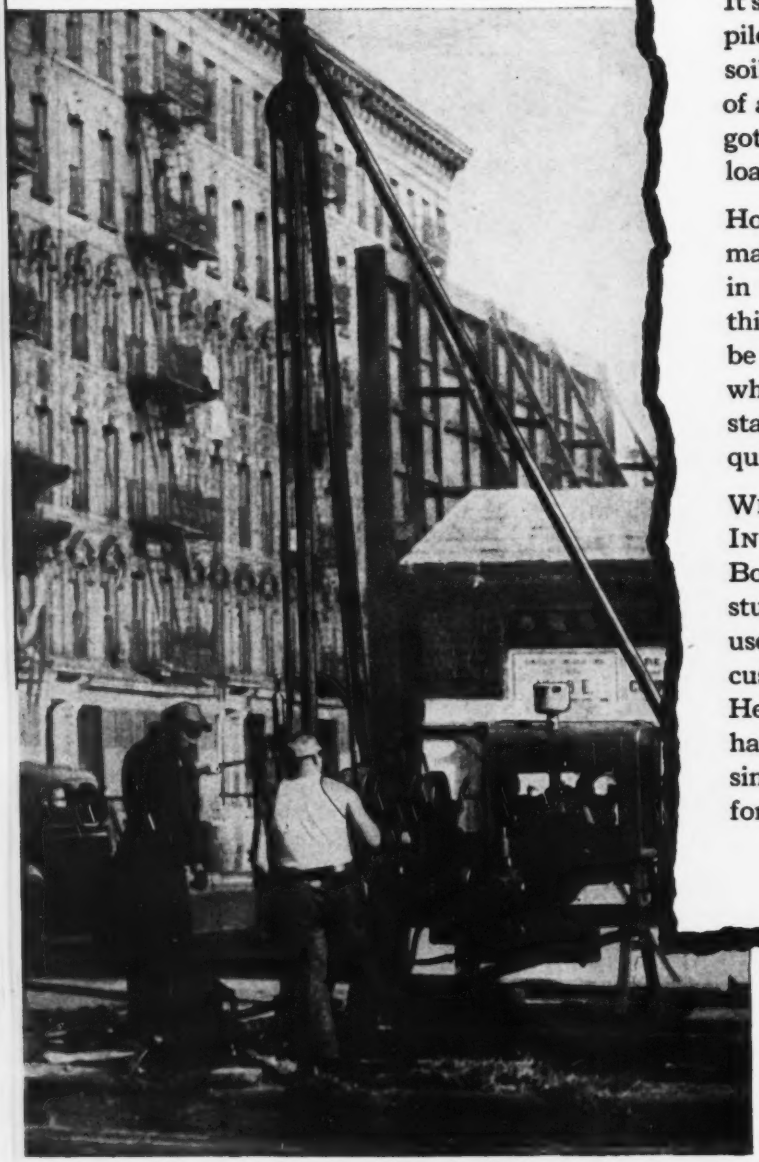
THE PILES SUPPORT THE STRUCTURE . . .

But What Supports the Piles?



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Construction Trends

Proposed Industrial Building Four Times 1947 Contract Volume

Industrial building contracts of $260,081,000 reported by *Engineering News-Record* in the first 14 weeks of 1948 are 21 percent above their 1947 dollar volume but 3 percent below the 1946 volume.

Building costs have risen 35 percent since the first quarter of 1946, however, and the physical volume of industrial building is only 8 percent above the 1947 volume and 27 percent below the 1946 volume.

Industrial building made a recovery in February from the low volume recorded in January as measured by a four-week moving average of contract awards. The moving average rose from the 1948 low of $5,523,000 in mid-January to $19,993,000 in mid-February. This February average was nearly equal to the corresponding 1946 average of $20,096,000. Although contract awards have declined since February, the four-week moving average of $32,053,000 for the first week of April is now above the 1947 average of $14,609,000 and the 1946 average of $18,000,000.

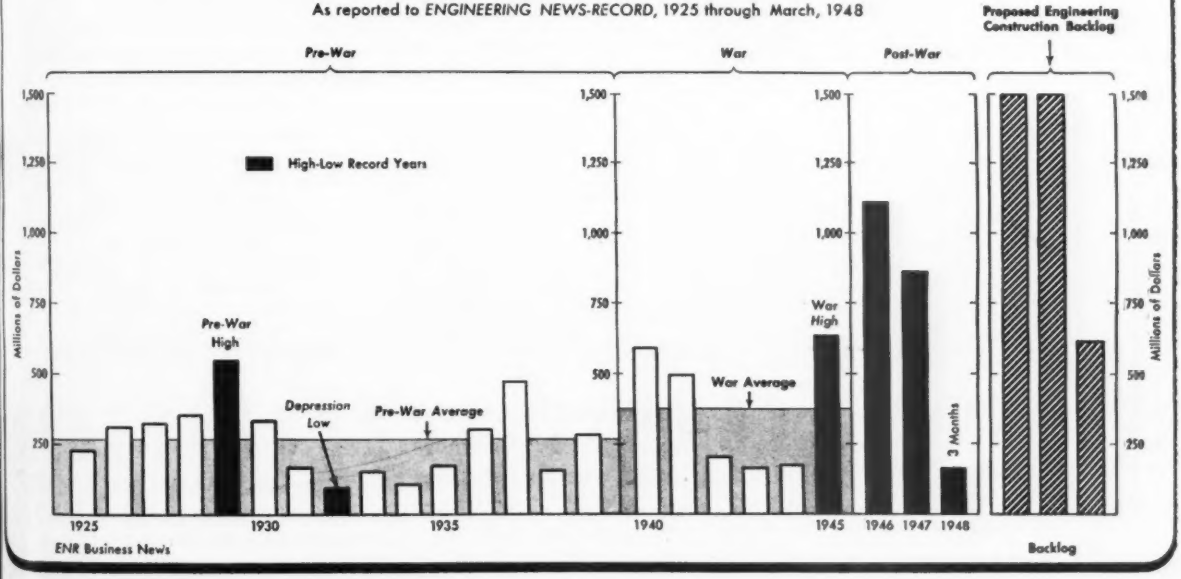
Public utility building contracts rose to $58,816,000 for the first 14 weeks of 1948 from $34,036,000 a year ago, or 73 percent. Public utilities borrowed or raised $281,179,000 in the first quarter of 1948, or 66 percent of the total new capital for private construction as recorded by *Engineering News-Record*.

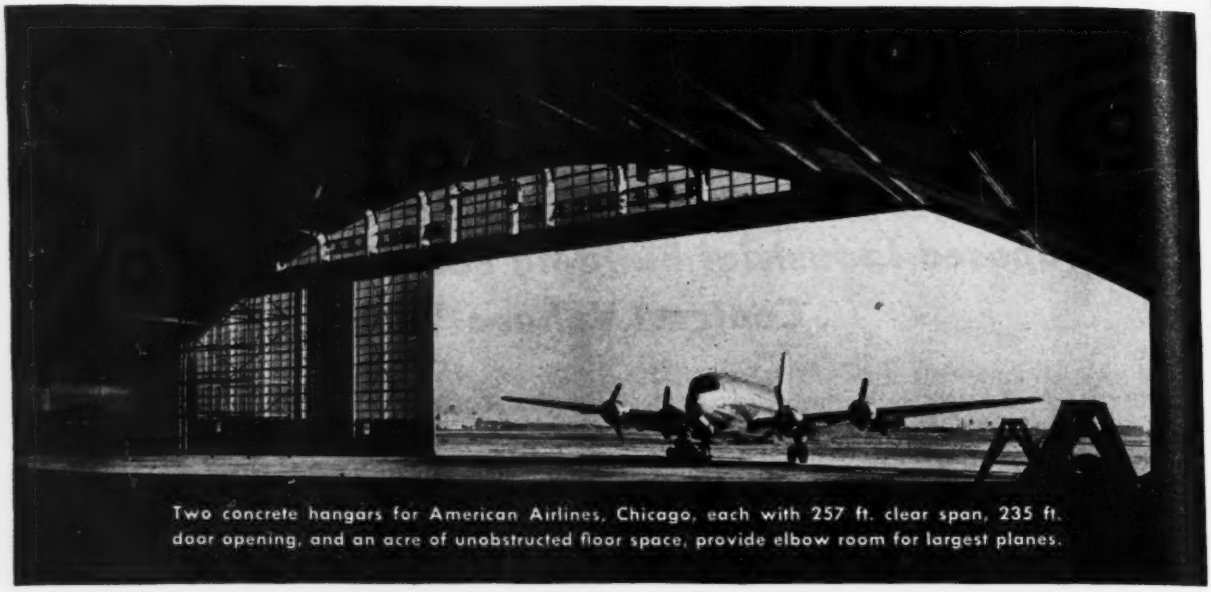
At the end of March 1948, the backlog of proposed industrial building projects on record with *Engineering News-Record* was $3,646,030,000, an increase of $102,366,000 in the first quarter compared with an increase of $367,757,000 in the first quarter of 1947. Thus, the rate at which the backlog has been accumulating declined to $34,000,000 per month this year from the monthly rate of $123,000,000 in the first three months of 1947 and from the $95,000,000 per month increase for the full year of 1947. Despite this slowing down in the accumulation of proposed projects, the backlog total is still over four times the 1947 dollar volume of building.

In the first quarter of 1948, $79,000,000 advanced to active status from the backlog of proposed industrial building. An additional $84,471,000 went under contract direct without first having been recorded as proposed. This is a ratio of 48 percent of new construction coming out of the record backlog. In the same period of 1947, $103,420,000 advanced to active status from the backlog, representing 54 percent of new contracts reported. The proposed industrial building backlog on record with *ENR* is thus apparently only half of the total volume of construction.

PROPOSED BACKLOG OF INDUSTRIAL BUILDING CONSTRUCTION COMPARED WITH ANNUAL CONTRACT VOLUMES

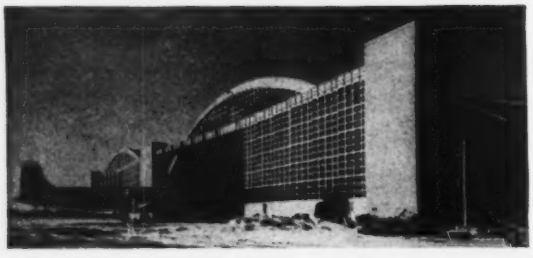
As reported to *ENGINEERING NEWS-RECORD*, 1925 through March, 1948





Two concrete hangars for American Airlines, Chicago, each with 257 ft. clear span, 235 ft. door opening, and an acre of unobstructed floor space, provide elbow room for largest planes.

Wingway FOR SKYBIRDS WITH 230-FT. WINGS



THE nation's largest commercial airline hangar, recently completed for American Airlines at Chicago, dramatically expresses the adaptability of concrete in the hands of imaginative designer and concrete-minded constructor. Of thin-shell, arch-rib construction, the building consists of two reinforced concrete hangars and leanto space, all part of one structure. Each hangar has an acre of unobstructed floor area. Hangar doors provide clear openings of 235 x 41 ft.; an additional opening accommodates a tail 54 ft. high. The hangars can easily house even the largest commercial planes, as well as latest military craft with 230-ft. wing span.

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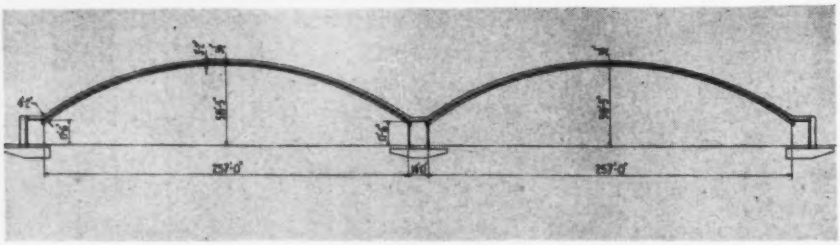

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News of the Week

ENGINEERING NEWS-RECORD • APRIL 1, 1948 • VOLUME 140 • NUMBER 14

Sanitary engineers see need of catastrophe organization

National Research Council committee urges sanitary group program within any national emergency plan to safeguard public in event of attack

Creation of a permanent sanitary-engineering unit in the U. S. Public Health Service, to carry out disaster and national security activities is recommended in a report of the committee of sanitary engineering of the National Research Council, which has just been made public.

The report was prepared by a subcommittee charged with the task of reviewing the hazards, organization and relief aspects of major catastrophes affecting the civilian population in time of peace or war.

Stating that under present world conditions it would be "entirely unrealistic" to assume that future wars could be avoided, the report says: "The cushion of time and distance which in previous wars made it possible for this nation to delay organizing programs of civilian defense no longer exists."

It was pointed out that the potentialities of atomic and bacterial warfare and of well-planned sabotage must be given consideration in plans for national security. Through such measures, an enemy nation might seriously attack our war resources in materials, production, transportation and manpower.

"Such an attack would affect areas of our civilian economy in which the sanitary engineer has a direct responsibility and where his special training qualifies him to serve in a program of defense or prevention."

Organizing for disasters

Calamities due to natural phenomena or man-made accidents, or those resulting from acts of warfare such as direct enemy attack or sabotage, involve a wide range of sanitary engineering problems. A consideration of these basic factors indicates that planning for prevention and control over major disasters should originate at a high federal level and be worked out in such detail as to reach down to each community in the nation. The policies, procedures and organization for carrying out the work should be such as to provide for efficient and effective operation in times of peace or war and to permit a rapid transition to meet circumstances.

Basic planning at federal level

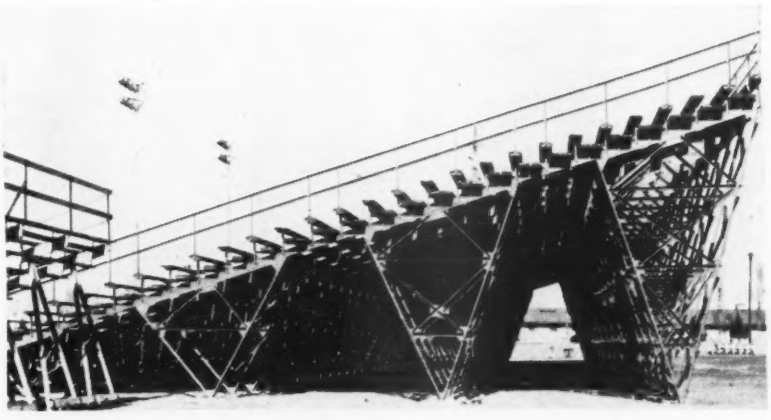
At the federal level the prime responsibility for developing programs and policies to prevent major disasters and to see that prompt remedial and relief actions are taken when they do occur should rest in the National Security council recently authorized by the Congress. At the state level, corollary relief actions in accordance with a well integrated national program should be taken under the emergency powers of the respective governors, authorized by proper enabling legislation. State funds, supplemented by American Red Cross and federal emergency funds, when necessary, are a prerequisite.

Considering the importance of environmental sanitation in disaster relief work and national security, the committee recommends that special provision be made to develop sanitary engineering programs within the national disaster relief and security program and to place responsibility for them in qualified sanitary engineers.

Currently there are numerous federal, state, local and even private agencies carrying out programs and research work having special relationship to environmental sanitation, and therefore, of concern to sanitary engineers. There is need for coordination of this work so that there may be a free exchange of information and experiences, elimination of any unnecessary duplication, and integration of effort for maximum usefulness in case of major disaster in peace or war.

"The necessity of secrecy in certain types of research and development work is recognized," says the report, "but this should not be carried to such an extent as to exclude considerations of potential hazards to man and his environment involving sanitary engineering matters."

(*Continued on page* 56)



Cheap Seats—By using inverted towers so spaced that there is no top span of more than six feet, engineers building new bleachers for the University of New Mexico Stadium at Albuquerque said they achieved more clear space under the stands, and used less steel per seat than would be required for conventional vertical towers. F. C. Torkelson Co., Salt Lake City, Utah, designed the new stand.

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Public construction—Loyola University, *Chicago, Ill.*, plans a $5,750,000 building, for its medical and dental colleges . . . *Broome County, N. Y.*, has started plans for the second stage of the $4,700,000 Mt. Ettrick airport project . . . Middle Tennessee State College has a 1948 construction program of more than $1,000,000 . . . Vermont's State Emergency Board authorized a $1,950,000 bond issue for a state building program including a state office building at *Montpelier*, a state school and a state hospital at *Waterbury*, and building at the agricultural college at *Burlington* . . . The state of *Florida* plans to have $30,000,000 worth of new buildings completed or under contract by July 1.

Industrial construction—Kennecott Copper Corp. has plans for construction of a large refinery in *Utah* . . . A general contract to construct a $30,000,000 mill for the Coosa River Newsprint Co., at *Childersburg, Ala.*, has been awarded to the Daniel Construction Co. of *Birmingham* and the F. H. McGraw Construction Co. of *Hartford, Conn.* . . . Atlantic Refining Co. is building new production laboratories costing $2,000,000 near *Dallas, Tex.* . . . *Newport Beach, Calif.*, has approved construction of a $2,500,000 yacht club and resort hotel projected by the Harbor Investment Co. . . . The Maytag Co. plans a $5,000,000 plant at *Newton, Ia.*

Highways—Work is starting on a $400,000 bridge and draw over the Indian River at *Titusville, Fla.* . . . Pennsylvania has rejected as too high bids received for the construction of 4225-ft.-long twin tubes under *Squirrel Hill*, on the Penn-Lincoln Parkway at *Pittsburgh* . . . *New Brunswick Province* has voted $2,430,000 for road and bridge work in 1948 . . . The *Illinois* highway department will rebuild 10 miles of Route 66 connecting *Chicago* and *St. Louis, Mo.*

Housing—*Franklin Square, N. Y.*, is to have a 500-home community in the $11,000 price range on part of the former Valley Stream golf course, financed by Phoebus Kaplan . . . Wartime Housing Ltd., *Canada*, has built 30,841 dwellings, of which 17,116 were of four rooms, and 77,000 homes were completed in Canada last year . . . Work is starting on 32 buildings, with 205 apartments at *St. John, N. B.*

Sewers and water supply—The *Missouri* Supreme Court has upheld the validity of the $800,000 in bonds for improvements to the waterworks and sewer system of *Kirkwood* . . . *Columbia, Mo.*, has approved $1,500,000 bond issue for a municipal and electric light plant . . . A 19.5-mile water main is being considered in *Minneapolis, Minn.*

Dams—Award of a contract to McCree & Co., *St. Paul, Minn.*, for the first stage of the Dry Run flood control project at *Decorah, Ia.*, has been made at $695,000 . . . The district engineer, *Rock Island, Ill.*, has been directed to prepare definite plans for the Red Rock reservoir on the Des Moines River in *Iowa*.

Hospitals—Contract for construction of a 155-bed tuberculosis hospital at *Portland, Ore.*, has been awarded by the Veterans Administration to the Del E. Webb Co., Los Angeles, on a bid of $2,562,952. The hospital will be seven stories high and of concrete construction with brick veneer . . . Plans have been approved for a $1,400,000, five-story building at Genesee Hospital, *Rochester, N. Y.* . . . Contracts awarded on the 1,000-bed VA Hospital at *Albany, N. Y.*, include: Ring Construction Corp. of Minneapolis, Minn., a $9,854,000 contract for the main building and wing.

Press Assn. photo

River Street—Market Street in Warren, Pa., became a part of the Allegheny River last week, as spring thaws melted heavy snow-cover and sent streams over their banks in the northern section of the United States. Hardest-hit areas appeared to be southwestern New York State and northern Pennsylvania. Midwest areas, meanwhile, suffered damage from a series of freak windstorms.

Plan $8 million bridge for Yorktown, Va.

Army engineers last week announced approval of a proposed double-leaf horizontal swing bridge, 2,540 ft. long, over the York River at Yorktown, Va.

Virginia highway department engineers said it will take from four to six months to prepare plans for the bridge. The structure will be the first link in a system of toll-free highways planned to connect the Yorktown peninsula with the mainland.

The state also plans acquisition of the privately-owned James River bridge system and a bridge over the Rappahannock at Grey's Point.

It is expected that the Yorktown bridge will cost about $8,000,000 and that more than a year will be required to build it. The state will charge tolls on the Yorktown and Rappahannock bridges until the bond issue is paid off.

Plan Maine structure

The Maine Highway Commission said last week it would receive bids until April 14 for construction of a part of a $2,500,000 bridge across the Kennebec River at Augusta.

Two contracts will be awarded—one for the substructure of two abutments and ten piers; the other for the superstructure, which will include 3,100 tons of steel. Plans for approaches have not yet been completed, and contracts for this work will be let at a later date.

Shortage of new highway engineers reported at Ohio road conference

Trends in road building methods and equipment also reviewed during three-day meeting in Columbus, Ohio

Only 511 of the 2,883 civil engineers being graduated this spring from 116 leading U. S. engineering schools are interested in entering highway work. Additionally, in nearly all cases, the graduates expressing preference for highway employment stipulate that compensation in this field of engineering be competitive with that offered civil engineers by private industry.

This startling disclosure was made by Hal H. Hale, executive secretary, American Association of State Highway Officials, before some 670 engineers attending a highway engineering conference held in Columbus, Ohio, Mar. 23-25. The conference was sponsored jointly by the civil engineering department of Ohio State University, and the Ohio Department of Highways.

Details of this survey of engineering colleges, just completed by the AASHO, will be published in an early issue of the association's journal, *American Highways*, said Mr. Hale, who warned that drastic steps must be taken immediately if more graduates are to be attracted to highway engineering.

"Increasing the salary rates alone will not solve the problem," he said, "but in addition job-classification systems must be established by the highway departments to insure proper promotion for the engineer."

Of the 116 engineering schools reporting, 39 have no civil engineering graduates interested in highway work. The five leading engineering schools in Ohio reported that only 16 of their 73 graduating civil engineers have expressed any preference to become highway engineers, said Mr. Hale.

National issues discussed

Although one open forum and some informal discussions centered on local highway problems in Ohio, several prominent speakers on the program lent an atmosphere of national interest to the three-day conference.

In presenting the long-range view of needed highway construction, nationally, G. Donald Kennedy, vice-president, Automotive Safety Foundation, cited three fundamentals requirements of a modern approach to solving a state's highway problems. They are: (1) provide safe and adequate-capacity streets and highways, (2) establish an orderly program of construction based on priority of traffic needs and (3) set up a highway financing program based on sound economy.

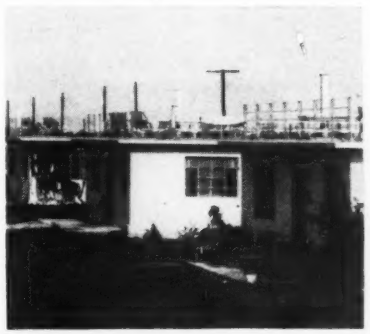
"Within the next 15 years," predicted Mr. Kennedy, "we can expect a 50-percent increase in motor vehicle travel over prewar years. And, within the next nine years we can expect 45,000 mi. of primary and secondary federal-aid highways to deteriorate beyond the point of economical maintenance."

Urban program lagging

Under the present construction program, said Mr. Kennedy, the development of urban highways is the most lacking. This veiw also was held by Walter Graf, city engineer, Lancaster, Ohio, who pointed out that the badly-lagging urban highway program in many Ohio cities is due to two factors —inability of the cities to finance their share of the cost of construction, and lack of capable planning personnel.

These are serious problems in Ohio, said Mr. Graf, since it is one of the most highly urbanized states in the country—containing 59 cities of over 10,000 population. Proper and adequate urban planning now, will result in substantial savings in construction costs.

Reporting on significant trends in highway design and construction, T. J. Kauer, managing director, Wire Reinforcement Institute, declared that ready-mixed concrete now is permitted by 40 state highway specifications. Similarly, tandem mixing of concrete pavement has gained general acceptance as evidenced by use in 38 states.



Suntan Acres—Flat-roofed to provide a sun-deck living space, nearly 1,000 of these basementless concrete homes are now under construction in Miami, Fla. Homes are 26 x 32 ft., have a 4-in. reinforced floor slab and 8-in. walls, with a roof slab varying from 6-in. thick at center to 4-in. at outside walls. Selling price is about $7,800. Builder is Florida Sun Deck Homes Inc., Hialeah, Fla.

Concrete finishing machines for roadway pavement now are required by all but one of the state highway departments, continued Mr. Kauer, mechanical vibrators by 20, longitudinal mechanical floats by 39 and hand-brooming by 26. There also is a trend toward the greater use of mechanical concrete spreaders, although to date they are required by only 10 states.

Distributed reinforcement is gaining wide usage, declared Mr. Kauer, with 38 state highway departments specifying its use either in the form of welded wire fabric, reinforcing bar mats or expanded metal reinforcement.

Although great advancements have been made by state highway departments in the design and construction of highway pavement, Mr. Kauer ventured the opinion that much of the benefits from research in concrete pavement made during the past 25 years is lost on construction through careless or indifferent construction methods and, in some cases, by incompetent engineers and inspectors. Moreover, said he, there is less agreement among the state highway departments in the method of proportioning concrete than in any other feature of concrete construction.

Flexible pavements

Bernard Gray, chief engineer of The Asphalt Institute, reporting on developments in flexible pavements, declared that newly developed vibrating machines for adding mineral choke to waterbound bases will substantially increase the structural strength of this type of asphalt-surfaced pavement.

"Particular emphasis should be placed on salvaging existing pavements, said Mr. Gray, "in view of the large volume of materials currently needed for new highway construction. One of the greatest needs today is to widen and resurface paralleling roads in certain badly congested areas. When this has been accomplished, traffic will tend to disperse itself onto the improved routes."

Supplementing the technical sessions devoted to trends in new construction equipment, was a "road show" held in connection with the three-day conference. Sponsored by the Ohio Equipment Distributors Association, under the chairmanship of K. O. Dinsmore, executive-secretary of the association, this exhibit included several improved models ranging from portable mechanical earth-tampers to the largest crawler-type tractor. Emmett H. Karrer, professor of highway engineering, Ohio State University, was in over-all charge of the highway conference.

Sanitary engineers urge disaster plan

(*Continued from page 53*)

In the opinion of the committee, the sanitary engineering division of the U. S. Public Health Service, by reason of its specially-trained staff and established relationship with the sanitary engineering divisions of state, county and local departments of health, is particularly well qualified to serve as a liaison unit between federal agencies and those of the respective states and their instrumentalities.

Working with these agencies, this unit would perform such functions as:

A. Coordinate sanitary engineering work between federal, state and local agencies, with special emphasis on mitigation of hazards to civilians in times of peace or war.

B. Develop plans in consultation with an over-all agency, for the organization and mobilization of sanitary engineers, waterworks operators and related manpower for service in local, regional or national emergencies.

C. Promote civilian defense and disaster-relief planning, involving sanitary engineering and environmental sanitation, through the chief sanitary engineers of the state departments of health.

D. Develop a system of liaison and intelligence whereby in the location, design, construction and operation of public facilities the interests of national security are taken into adequate consideration.

E. Alert state and local agencies of such national defense programs as are likely to affect community resources or facilities for which they are responsible.

F. Develop training programs in environmental sanitation for professional and sub-professional people in order to establish a reservoir of trained personnel for service in times of disorder.

Committee makes report

Members of the subcommittee making the report were: Arthur E. Gorman, chairman, sanitary engineer, Bethesda, Md.; Gerald E. Arnold, director, water department, San Diego, Calif.; A. F. Dappert, principal sanitary engineer, New York State Department of Health; Victor M. Ehlers, chief engineer, Texas State Department of Health; and H. H. Gerstein, chief filtration engineer, Chicago Department of Public Works.

Chairman of the Commission on Sanitary Engineering and Environment, which forms part of the Division of Medical Science of the National Research Council, is Abel Wolman, professor of sanitary engineering, the Johns Hopkins University, Baltimore.

Hard Rock—Construction of the Detroit dam on the North Santiam River in western Oregon has necessitated the relocation of a 9.8 mile section of highway at a cost of more than $3,700,000. Much of the construction is through solid rock, while at other points earth fills as deep as 300 ft. must be completed. Workmen for Kuckenberg Bros., Portland—contractors on the section—here sink drill holes for blasting around the face of a basalt cliff where the rock is so hard that drill points sometimes dull before penetrating a formation more than two inches.

Building law violation caused apartment crash

Failure of a first floor wall section that had not been reinforced in compliance with regulations was named as the principal cause of collapse of the Empire building in Washington, D. C., last Dec. 16, in a report issued last week.

The Empire building, a 54-year-old apartment building at 9th St. and New York Ave., N.W., in Washington was the scene Dec. 16 of a collapse of six of its twelve floors, which killed four and caused injuries to twelve residents. (*ENR*, Dec. 25, 1947, vol. p. 853).

The building was of wall-bearing construction, seven stories in height, with a basement. Early in the century, a hole was cut through one of the wall-bearing partitions in the basement, and in 1932 this opening was enlarged. Other changes were made later. Result of these changes was overloading of a pier of brick construction, which failed in compression.

Sanitary group considers U. S.-Mexico problems

Mutual sanitary engineering interests of the United States and Mexico were considered at the recent sixth annual convention of the United States—Mexico Border Public Health Association, held at the twin-cities of Laredo, Tex., and Nuevo Laredo, Tamaulipas.

The group reaffirmed the necessity of a world health organization and endorsed the Pan American Sanitary Bureau's cooperation program for the western hemisphere, under which the bureau will act as the coordinating agency in health and sanitation programs on both sides of the border.

Sanitation problems of the border cities from the Gulf of Mexico to the west coast were discussed including tuberculosis, venereal disease control, maternal and child health, and health education measures.

The president, James R. Scott, state health officer of New Mexico, presided, at the sessions. Victor Ocampo Alonzo, state health officer of Sonora, Mexico, was installed as new president at the final session.

Sponsoring organizations of the association include: Ministry of Health and Welfare, Mexico, the Pan American Sanitary Bureau, and the Institute of Inter-American Affairs. Cooperating bodies are the Children's Bureau of the Department of Labor, Rockefeller International Health Foundation, and the Mexican Ministry of Hydraulic Resources.

Urge 1.5 million yearly housing rate

An 18-point program for federal government action to provide more adequate national housing was recommended in a recent report by a joint House-Senate committee on housing.

The report, a final phase of a lengthy investigation into housing matters that in one section called housing a "miserable failure" (*ENR* Jan. 22, vol. p. 94) was submitted to the national legislature by Representative Ralph A. Gamble.

Finding that home-building has lagged behind other industries in the industrial and technical developments and that homes are being provided at prices that only higher income families can afford, the committee urged Congress to enact "comprehensive legislation" to enable home production at the rate of 1,500,000 dwellings per year. Principal objective of the program is stimulation of private building, the committee said, and only one of its eighteen points dealt with public housing and one with slum clearance assistance.

Seek research program

The committee recommended establishment of a research program aimed at cost reductions through development of more efficient techniques; a study of the materials requirements for a $1,500,000 yearly construction rate; increased apprentice training; and "vigorous prosecution" of producers and distributors of building materials who act in restraint of trade.

To maintain availability of mortgage funds, the group asked that the mortgage-insuring Title VI of the National Housing Act (an emergency program that provides for 90 percent loans to builders) be extended until March 31, 1949, with greater emphasis on assistance to rental housing in order to make an orderly transition to the Title II permanent programs. It was suggested that the Federal Housing Commission be permitted to raise the maximum interest rate from 4 to 5 percent.

Loans to prefabricators

Also recommended was extension for at least one year of Section 609 of the housing act, authorizing insurance of loans to prefabricators, and insurance of construction loans to large-scale builders using on-site mass-production methods. Further, the committee urged that secondary mortgage activity should be established within the housing and home finance agency and that similar activities that have been conducted by the Reconstruction Finance Corporation be liquidated.

Publication of the committee's final report brought immediate criticism from the Building Products Institute which, in a press release, characterized the report as "grossly unfair" to the building industry and charged that there was an "obvious attempt to help prove a case for public housing."

Douglas Whitlock, chairman of the institute, declared that the committee had ignored documented reports of industry progress in cost reduction and new techniques.

Omnibus housing bills put before Senate

Almost identical omnibus housing bills aimed at a long-range solution of U. S. housing problems were introduced into the Senate last week by Senators McCarthy and Flanders. The McCarthy bill was sponsored in the House by Rep. Fletcher, of California. The major difference in the measures is that Sen. Flanders' bill includes public housing and more extensive provisions for research.

The measures would supersede the Taft-Ellender-Wagner Bill (*ENR* March 27, 1947, vol. p. 481) on which the Senate has failed to act.

Our apologies!
ing a new 22 story annex is a noisy business... a
regret any annoyance it may cause our neighbor
more weeks till
we finish the.
WRECKING
OIL COMPANY OF CALIFORNIA

***Beg Pardon**—Taking a leaf from the notebook of other California builders (ENR Feb. 5, vol. p. 169) the Standard Oil Company of California posted this sign while its contractors were at work wrecking an old building on the site of a 22-story addition to its San Francisco offices. Printed notices of the work in progress were also mailed to occupants of neighboring office buildings.*

Industrial building work reaches postwar peak

Construction contracts let for industrial buildings for the week ending April 1 reached a postwar high figure.

The previous high since the ending of hostilities was recorded in the week of Dec. 4, 1947, when the contract total hit $214,014,000.

Extend FHA housing insurance limits

A bill (H. R. 5854) increasing by $2,000,000,000 the authority of the Federal Housing Administration of the Housing and Home Finance Agency to insure mortgages for new housing construction has been passed by the House and sent to the Senate.

At the same time the Senate passed a separate bill extending the FHA insurance authority for one month beyond March 31, and authorizing an added $400,000,000 for home-loan insurance.

The measure extends and amends Title VI of the National Housing Act. This section of the act is now extended to March 13, 1949, with the increased mortgage authorization consisting of $1,000,000,000 statutory and $1,000,000,000 to be made available at the discretion of the President. If the bill becomes law the total authorization, including the discretionary fund, would be $6,950,000,000.

In the form passed by the House, the FHA Administrator was granted discretionary authority to approve loans bearing interest up to 5 percent yearly. The existing law sets a maximum rate, of 4 percent, and the change would permit the federal officials to set the rate as high as 5 percent in certain areas under special conditions.

The Senate-approved bill (S. 2361) is a stop-gap measure to allow the Senate more time in which to consider the bill passed by the House.

Both houses have passed and sent to President Truman for his signature still another bill (S. 2182) extending for one year rent controls otherwise due to expire March 31. This bill eliminates a regulation requiring that permission be obtained from the Office of the Housing Expediter for construction of amusement and recreational facilities (*ENR* July 10, 1947, vol. p. 23). The President has indicated he will sign the bill now on his desk.

In the period from July 1, 1947, to March 19, 1948, the housing expediter approved 739 applications valued at more than $29,000,000 for amusement facilities and denied 2,029 projects estimated to cost nearly $90,500,000. More than half of the applications—both those approved and those denied—were for movie theaters.

$3.5 billion college buildings needed

American colleges and universities have 341,550,000 sq. ft. of building space and need an additional 265,000,000 sq. ft. in order to accommodate vastly increased enrollments anticipated by 1950, the U. S. Office of Education said last week.

This proposed increase of 78 percent in present plant, with land, equipment, and miscellaneous costs added, would cost more than $3,500,000,000 officials said. A total enrollment of 2,675,000 is expected by 1950.

The tremendous demand for educational and student residential housing has been brought about by the enrollment of nearly a million more students than the prewar plants accommodated. The shortage has been intensified by the inability to replace obsolescence and losses of buildings during the war, and by the need for housing new programs required in providing education for veterans.

College and university need for additional space had become so urgent that nearly two years ago—in August, 1946—Congress authorized the U. S. Commissioner of Education to determine actual and impending shortages of educational buildings and equipment. The Federal Works Agency received an $84,650,000 appropriation for administration and for use in dismantling, removing, and re-erecting on school and college campuses available war surplus buildings required to meet the needs certified by the Commissioner of Education.

At the end of 1947 the Veterans Educational Facilities Program, administered jointly by the U. S. Office of Education and the Federal Works Agency, had determined that acute shortage of buildings required in providing education for veterans existed in 1,150 institutions in the amount of 23,000,000 sq. ft. At that time the Federal Works Agency had completed or had under construction 16,500,000 sq. ft. of space to which most of the appropriation had been allocated. To date federal expenditure has averaged approximately $5 per sq. ft. or 33 cents per cu. ft.

In 1947, the amount of educational space in publicly-controlled institutions was 119,738,000 sq. ft. or 124 sq. ft. per full-time student; in privately-controlled institutions it was 102,751,000 sq. ft. or 128 sq. ft. per full-time student.

The tables reproduced show combined present and additional educational space which it is estimated will be needed by 1950.

The composite picture of college and university building needs for the next decade has been made from the generally conservative reports of presidents and business officers.

The full report with tables and other data may be obtained from the U. S. Officer of Education, Federal Security Agency, Washington 25, D. C.

Texas blueprints road safety measures

A 23-point program for immediate and long-range reduction of highway accidents was submitted to Governor Beauford Jester of Texas last week by engineering members of the governor's highway safety conference.

Headed by Gibb Gilchrist, president of Texas A. & M. College, and DeWitt C. Greer, head of the state highway department, the group urged for immediate attention:

Establishment of full-time traffic engineering units for all cities over 100,000 population, and employment of a full-time expert for advice on traffic engineering in cities under 100,000; training of traffic control officers in special short courses; adoption of standardized interpretations of control ordinances by judges, police and other enforcement agencies; standardization of traffic and highway markings, restriction of parking in cities to permit easy traffic movement; elimination of grade crossings; improvement of lighting on major traffic arteries, and introduction of traffic safety engineering as a part of college courses on highway or automotive engineering. Long-range recommendations included removal of outdoor advertising that distracts or endangers drivers.

Report Penn. Turnpike extension to start soon

According to the *Philadelphia Bulletin*, the 140-mile extension of the Pennsylvania Turnpike from Carlisle to Philadelphia will be started next fall. It probably will follow a northerly route passing south of Lebanon and Reading and joining Philadelphia local highways at King of Prussia, Montgomery County, to dovetail with the proposed Valley Forge project.

The probability of the northern route being chosen was indicated after an aerial survey that cost about $86,000 and took several months.

Idaho power to build new Snake River Dam

The Idaho Power Co. has been granted a 50-year license and authorization from the Federal Power Commission to build a new hydroelectric project on the Snake River, 5 miles downstream from Bliss, Idaho.

To be known as the Bliss development, the project will include a concrete dam 600 ft. in length, and a powerhouse with a three unit installation of 69,000 kw.

NSPE officers, directors hold annual meeting

Meeting with the national organization's board of directors, presidents of the state groups of the National Society of Professional Engineers recently reaffirmed the organization's labor relations policies and approved a five-point legislative principle platform for 1948.

The meetings, called officially the Third Annual State Presidents Conference, were held in Detroit, Mich. They marked inauguration of a joint meeting program for members of the board and the state society leaders.

The legislative principle program included:

Affirmation of NSPE's opposition to closed-shop provisions affecting professional employees in and opposing mandatory membership for professional employees in bargaining groups containing non-professional personnel; opposing performance of engineering practice by governmental agencies; and advocation of work to strengthen and implement state engineering registration laws.

Two new member state societies—one in Florida and one in Idaho—were accepted for membership, bringing the total number of states in the organization to 27, plus the District of Columbia and Porto Rico. Dates for the 1948 annual meeting were set for Dec. 16 and 17 in Chicago.

Ohio branch fosters registration

Acting for the Ohio Society of Professional Engineers, in Columbus, E. C. Luaces of Dayton, on March 18 filed an injunction suit in Delaware County Common Pleas court to restrain Henry Turner from engaging in the practice of professional engineering.

This is the seventh injunction suit filed by the society to enforce the rule requiring state examination and registration of professional engineers. Three suits have been won, and four are pending in the courts.

Court OK's "anticipation" of Florida gas-tax funds

The Florida State Supreme Court ruled last week that the state may pledge anticipated surplus gasoline taxes to redeem road and bridge revenue bonds.

The decision validated a plan under which the certificates are issued by the State Improvement Commission and retired in the form of "rentals" from the highway department out of surplus gasoline tax collections.

Writing the majority opinion, Justice H. L. Sebring said that the court considered that any ruling to limit state road department expenditures to those gas tax funds on hand would result in piecemeal construction of public highways. However, the court warned that only surplus gasoline tax funds could be pledged to retire the certificates.

The improvement commission has already sold $1,225,000 worth of certificates to finance various road and bridge construction projects.

Funds sought for land for second Bay bridge

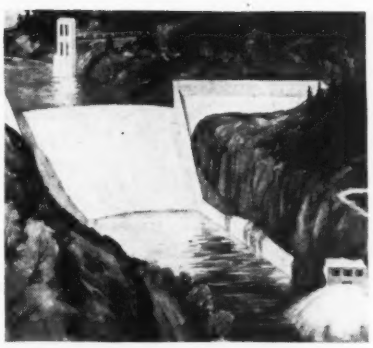
The California legislature is being asked to approve a $675,000 payment for land parallel to the anchorage of the present Bay bridge to permit soundings for a second bridge—$398,500 to go to the Sailors Union of the Pacific, which had started construction on a $1,000,000 building there. (*ENR* Nov. 27, 47, vol. p. 721)

Director of Public Works Charles Purcell denied that the expenditure would commit the state to building a parallel bridge, explaining that both this and a southern site were being studied.

Three pieces of land are included in the site.

Penna. limits truck weights to halt road damage

Truck weight restrictions of 10 tons or less have been placed on many secondary state highway routes in Pennsylvania because of frost damage, Warren K. Myers, chief maintenance engineer, has announced. So far it has not been necessary to post any of the main routes. The postings will be lifted as soon as the frost condition is corrected and the subgrade dries, Myers says. A recent thaw has caused considerable damage to roads in the bituminous coal area, where heavy trucking operations are carried on.



***Flood Control**—Army engineers of the Seattle District have recommended construction of the $16,000,000 Eagle Gorge Dam on the Green River, southeast of Seattle, for flood control. Here shown in model form, will be 190 ft. high.*

Construction workers gain wage increases

The Cleveland Building Trades Employers Association said last week it had concluded the first 1948 wage contract to be negotiated with the city's nineteen building craft organizations. The announcement was one of a series of moves throughout the United States in wage matters.

The Cleveland contract brings an increase of 12½ cents an hour for 1,500 members of the bridge and structural workers union, raising the rate from $2.25 to $2.37½ an hour. Two other building craft unions—the plasterers and the lathers—have tentatively accepted a $1 a day wage increase.

Two union groups in the Northwest also obtained wage increases.

Four building trade unions in the Portland, Ore. area obtained 17½ cents an hour through a decision of an arbitration board. The new scale gives carpenters $1.92½; laborers and teamsters $1.52½, and ironworkers $1.92½. At Tacoma, Wash., construction workers were granted pay increases averaging 15 cents an hour.

At Fargo, N. D., negotiating committees of the North Dakota Contractors Association and AFL craft unions met to discuss new wage agreements for all building trade unions excepting bricklayers.

At Tacoma, the South Bend Fabricating Co. filed a suit in federal district court asking damages totaling $316,910 from the AFL Carpenter Union Locals at Raymond and Aberdeen, Wash., on a charge of violation of the Taft-Hartley Act. The company, which builds prefabricated houses, said it was placed on the "unfair" list last June by the unions and then carpenters refused to handle its products.

Drop Bailey bridge plan for Agate Pass crossing

The Washington state highway department has abandoned plans to erect a Bailey bridge across Agate Pass but will build a temporary bridge of another type, according to Clarence B. Shain, state highway director. Use of a Bailey bridge was ruled out because of Navy Department objections.

A temporary bridge across the pass was proposed following the cessation of ferry service on Puget Sound by the Puget Sound Navigation Co. when the state refused to allow higher ferry rates. The company is now operating its boats under lease to the counties and thus escapes state rate jurisdiction. The state plans to inaugurate its own ferry service next year.

New plans call for a timber bridge laid on surplus pontoons to be acquired from the Army. The 2-lane roadway will be 1,400 to 1,500 ft. long. A 90-ft. movable section of the fixed bridge will permit vessels to pass.

Arkansas road repair to cost $8 million

The Arkansas state highway department will need about $8,000,000 to repair and rehabilitate fully the state's highway system after one of the worst winters in history, J. C. Baker, director of the department said last week.

"A check-up by district engineers has shown that it will take one and a half to two million dollars for emergency patching and filling of holes alone," Mr. Baker said. This expenditure will use up the department's surplus funds, he added. He said that use of these funds will prevent the state from matching about $7,500,000 in federal funds for highway work, and foresaw that the state might lose these funds this year.

Utility strike statute held unconstitutional

A Wisconsin law banning strikes against public utilities was declared unconstitutional last week in a ruling by Circuit Court Judge Alvin C. Reis.

The court said the law forces workers into "involuntary servitude," deprives them of their liberty without due process of law; and discriminates against them.

The antistrike law prohibits strikes, lockouts and slowdowns in telephone, gas, electric transportation, communication and other public utility companies, and sets up a system of conciliation and compulsory arbitration by the state.

Protest Army rejection of McNary Dam road

Protest against the rejection by Army engineers of plans for construction on an inter-state bridge atop McNary Dam has been sent to the United States Public Roads Administration by the Oregon and Washington State Highway bureaus.

Lt. Gen. R. A. Wheeler, chief of the Corps of Engineers, which has charge of the dam construction, disapproved the highway plan on the ground that it would interfere with facilities to protect the salmon run.

Plans approved by the highway bodies of the two states called for construction of a bridge on the crest of the dam, three miles upstream from Umatilla, Ore.

T. H. Banfield, chairman of the Oregon commission, pointed out that decision on the issue would establish a precedent and that when the Columbia River becomes a series of lakes under dam building, construction of bridges by the states would be very costly unless use of the dams is permitted.

May require X-ray test on welded steel joints

Anson Boyd, California state architect, reports that the division of architecture has under consideration a rule requiring that in school construction welded steel joints be X-rayed for flaws.

The architect emphasized that a public hearing would be held in advance before the regulation would be put into effect. There is a possibility that his office will decide the regulation is not necessary, he said.

Boyd asserted that the X-ray procedure was not expensive and would not make welded steel construction prohibitively expensive. The order is proposed under the architecture division's power to prescribe "earthquake-proof" construction for public schools.

Maj. Gen. C. R. Moore joins Koppers Company

Maj. Gen. Cecil R. Moore, who served for four years during the war as chief engineer in the European Theater of Operations, has been named manager of the construction department, Shops Division, of Koppers Company, Inc., Pittsburgh, Pa. During the last year, General Moore has been director of the Department of Aviation, Baltimore, Md.

***Minneapolis Hospital**—Construction is to start this spring on Mt. Sinai Hospital in downtown Minneapolis, Minn. Sponsored by the Jewish Hospital Association of the twin cities, the structure will be a 200-bed, nonsectarian medical center, to cost about $2,500,000. Lieberberg & Kaplan and Schmidt, Garden & Ericson are architects and engineers.*

Survey silting effects at Boulder Dam

A scientific survey to determine the effects of sedimentation at Boulder Dam is now under way, under the joint sponsorship of the departments of the Interior and the Navy.

A fleet of small boats has been transported overland by the Navy to Lake Mead and is manned by trained scientific technicians from the Navy's Electronics Laboratory and its Underwater Sound Laboratory. Engineers and geologists of the Interior Department's Geological Survey and the Bureau of Reclamation have general technical responsibility for the investigation.

When the work is completed, the Bureau of Reclamation expects to have answers to many operating questions posed by the steady accumulation of sediment in the huge reservoir.

Schuylkill desilting to cost $35 million

A revised estimate on the Schuylkill River desilting project in Pennsylvania places cost of the work to the commonwealth at $35,000,000, Gov. James H. Duff announced last week.

Bids are now under consideration for construction of a dredge and the building of five desilting basins.

The Governor listed probable costs as follows: Basins, $6,700,000; dredging, $12,200,000; 23 silt impounding basins, $4,200,000; hydraulic dredges, $1,000,000; engineering design and planning, $1,300,000; repair to dams and locks, $500,000; contingencies, $5,000,000.

New Mexico and Texas disagree on Pecos water

Another attempt to settle the 35 year old dispute between New Mexico and Texas over division of Pecos River waters ended in failure at a recent meeting in Santa Fe, N. M., of the Pecos River Compact Commission.

Texas representatives, headed by Charles H. Miller, demanded New Mexico deliver 293,400 acre-ft. of water annually to the Texas line. John Bliss, New Mexico member of the commission, proposed the water be divided upon the basis of available supply under present conditions.

The proposal and counter-proposal were turned over to an engineering advisory committee for further study.

Miller said Texas would oppose all improvements on the Pecos in New Mexico until a compact is reached, and said Texas is ready to take the question to the Supreme Court if necessary. The Texas legislature last year appropriated a substantial sum for court action to enforce Texas' demands for Pecos River water.

Bliss declared the Texas demands were much too high, and would place the full burden of river conditions on the state of New Mexico. He said the Texas demand for 293,400 acre-ft. of water annually represents an increase of 43,400 acre-ft. over the amount that actually would have passed the state line annually since 1905, under river conditions as they were in 1947.

Plywood manufacturers deny FTC trust charge

The Douglas Fir Plywood Association of Tacoma, Wash., last week denied all charges contained in a complaint filed by the Federal Trade Commission which said member industries have been violating anti-trust laws since 1936.

The complaint, filed in the federal district court at Seattle, charged that the association, with 32 member companies, three cooperating corporations and the Douglas Fir Plywood Information Bureau have "engaged in conspiracy to restrain and suppress competition in the sale and distribution of plywood products" by agreeing to fix and maintain prices, terms and discounts on plywood products.

The association and its member firms have been ordered to appear before the Federal Trade Commission April 9 at Washington, D. C.

Defendants said their firms had tripled production since 1936 and denied any price fixing.

OBITUARY

Harry L. Nickerson, 65, chief engineer of the Brooklyn Union Gas Co., N. Y., since 1940, died March 25. A graduate of Yale 1905, he later studied at M.I.T., and started as a laboratory assistant and testing engineer for the Peoples Gas Co., Chicago, in 1906. The next year he went to the Boston, Mass., Consolidated Gas Co. as assistant superintendent, and later became superintendent. In 1925 Mr. Nickerson was appointed engineer of manufacture for the Brooklyn Union Gas Co.

Gregg D. Wolfe, 75, civil engineer with the Scioto Valley and Traction Co. and its successor, Ohio Midland Light and Power Co., for 45 years, died Feb. 14 in Columbus, Ohio.

Charles M. Hirschfelder, 65, former city engineer of Rochester, N. Y., died March 18 in Syracuse. He was a graduate of the University of Toronto. He designed many residences in Rochester and while city engineer erected the city's disposal plant.

Robert David Caney, former civil engineer for public schools at Seattle, Wash., died March 15 at Port Angeles, Wash. He was a civil engineering graduate of the University of Michigan, Ann Arbor.

Laurence S. Ehrman, 66, retired engineer, died at Louisville, Ky., recently. A graduate of Purdue University, he had been with the U. S. Engineers for 30 years, having retired a year ago.

Frederick G. MacPherson, a civil engineer for about 50 years, died at Bridgewater, N. S., March 13. Educated at Dalhousie University, Halifax, he was long engaged in railroad engineering in Nova Scotia and British Columbia. At one time he was district engineer for Lunenburg County, Nova Scotia.

Andrew B. Larson, 75, assistant engineer of Salt Lake City, Utah, since 1932, died March 9. Active in many intermountain engineering projects, Mr. Larson was one of the first four graduates from Utah State Agricultural College to receive a civil engineering degree. He had been connected with the U. S. Bureau of Reclamation, Amalgamated Sugar Co., and as a consulting engineer on irrigation projects in Utah and Idaho.

Michael Heister, 77, who designed many Washington, D. C., landmarks, died there March 20. His firm designed such buildings as the Labor Department, Lansburgh & Brother department store, the Roger Smith Hotel and the American Federation of Labor Building. Earlier, he also designed many state buildings in the South.

Douglas W. Holton, 74, retired superintendent of the District of Columbia water department, died March 19 in Washington, D. C. After graduation from Vermont State University in 1898, he joined the district sewer department as an engineer and a year later was transferred to the water department. He retired in 1941.

Frederick M. Cronin, 62, formerly an engineer with the New York State Department of Public Works, died March 19 in Saranac Lake, N. Y.

Prof. Sybren R. Tymstra, 64, a member of the engineering faculty at the University of Washington since 1929, died March 23 at Seattle. Born in The Netherlands, he was graduated from Zwickau University, Germany, in 1905. He was employed by various engineering firms in Detroit and New York before joining the faculty.

Oscar W. Werwath, 67, founder and president of the Milwaukee School of Engineering, Milwaukee, Wis., died March 21.

Charles A. O'Quinn, 40, sanitary engineer of Madison County, Fla., died March 20.

MAJOR MEETINGS

American Society of Civil Engineers, spring meeting, Hotel William Penn, Pittsburgh, Pa., April 7-9.

Concrete Reinforcing Steel Institute, Edgewater Gulf, Hotel Edgewater Park, Miss., April 19-24.

Building Officials Training School, Drake Hotel, Chicago, Ill., April 26-29.

State Sanitary Engineers, Annual conference with Public Health officials, Washington, D. C., April 26-30.

National Public Housing Conference, Inc., Hotel New Yorker, New York, N. Y., May 3-5.

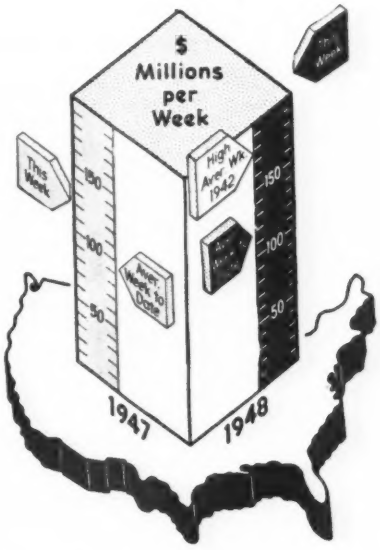
American Water Works Association, 1948 conference, Atlantic City, N. J., May 3-7.

Second Highway Transportation Congress, Mayflower Hotel, Washington, D. C., May 6-7.

Illinois Conference on Surveying and Mapping, Navy Pier, Chicago, Ill., May 7-8.

Society for Experimental Stress Analysis, The Roosevelt Hotel, Pittsburgh, Pa., May 27-29.

CONSTRUCTION ACTIVITY



As Reported this week to . . .
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only (Thousands of Dollars)

	Week of Apr. 1 1948	Cumulative 1948 (14 wks.)	Cumulative 1947 (14 wks.)
Federal	$31,266	$320,774	$108,369
State & Mun.	50,792	530,724	356,317
Total Public	$82,058	$851,498	$464,686
Total Private	136,726	791,980	853,952
U. S. Total.	**$218,784**	**$1,643,478**	**$1,318,638**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1948 (14 wks.)	Cumulative 1947 (14 wks.)
Waterworks ...	$1,914	$42,558	$29,545
Sewerage	3,481	44,398	22,010
Bridges	14,973	80,798	36,745
Highways	11,312	189,535	146,689
Earthwork, Waterways	3,432	147,813	52,724
Buildings, Public	43,669	291,829	124,726
Industrial ...	96,610	260,081	215,716
Commercial .	37,734	457,634	523,391
Unclassified ...	5,659	128,832	167,092

NOTE: Minimum size projects included are: Waterworks and waterway projects, $28,000; other public works, $50,000; industrial buildings, $68,000; other buildings, $250,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1948 (14 wks.)	Cumulative 1947 (14 wks.)
NON-FEDERAL	$875,582	$451,533
Corporate Securities	499,834	184,438
State and Municipal	375,748	267,095
**Total Capital ..... **	**$875,582**	**$451,533**

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost	Mar.'48	438.41	210.74
Building Cost	Mar.'48	329.03	177.86
Volume	Feb.'48	234	103

Protest Army rejection of McNary Dam road

Protest against the rejection by Army engineers of plans for construction on an inter-state bridge atop McNary Dam has been sent to the United States Public Roads Administration by the Oregon and Washington State Highway bureaus.

Lt. Gen. R. A. Wheeler, chief of the Corps of Engineers, which has charge of the dam construction, disapproved the highway plan on the ground that it would interfere with facilities to protect the salmon run.

Plans approved by the highway bodies of the two states called for construction of a bridge on the crest of the dam, three miles upstream from Umatilla, Ore.

T. H. Banfield, chairman of the Oregon commission, pointed out that decision on the issue would establish a precedent and that when the Columbia River becomes a series of lakes under dam building, construction of bridges by the states would be very costly unless use of the dams is permitted.

May require X-ray test on welded steel joints

Anson Boyd, California state architect, reports that the division of architecture has under consideration a rule requiring that in school construction welded steel joints be X-rayed for flaws.

The architect emphasized that a public hearing would be held in advance before the regulation would be put into effect. There is a possibility that his office will decide the regulation is not necessary, he said.

Boyd asserted that the X-ray procedure was not expensive and would not make welded steel construction prohibitively expensive. The order is proposed under the architecture division's power to prescribe "earthquake-proof" construction for public schools.

Maj. Gen. C. R. Moore joins Koppers Company

Maj. Gen. Cecil R. Moore, who served for four years during the war as chief engineer in the European Theater of Operations, has been named manager of the construction department, Shops Division, of Koppers Company, Inc., Pittsburgh, Pa. During the last year, General Moore has been director of the Department of Aviation, Baltimore, Md.

***Minneapolis Hospital**—Construction is to start this spring on Mt. Sinai Hospital in downtown Minneapolis, Minn. Sponsored by the Jewish Hospital Association of the twin cities, the structure will be a 200-bed, nonsectarian medical center, to cost about $2,500,000. Lieberberg & Kaplan and Schmidt, Garden & Ericson are architects and engineers.*

Survey silting effects at Boulder Dam

A scientific survey to determine the effects of sedimentation at Boulder Dam is now under way, under the joint sponsorship of the departments of the Interior and the Navy.

A fleet of small boats has been transported overland by the Navy to Lake Mead and is manned by trained scientific technicians from the Navy's Electronics Laboratory and its Underwater Sound Laboratory. Engineers and geologists of the Interior Department's

New Mexico and Texas disagree on Pecos water

Another attempt to settle the 33 year old dispute between New Mexico and Texas over division of Pecos River waters ended in failure at a recent meeting in Santa Fe, N. M., of the Pecos River Compact Commission.

Texas representatives, headed by Charles H. Miller, demanded New Mexico deliver 293,400 acre-ft. of water annually to the Texas line. John Bliss, New Mexico member of the commission, proposed the water be divided upon the basis of available supply under present conditions.

The proposal and counter-proposal were turned over to an engineering advisory committee for further study.

Miller said Texas would oppose all improvements on the Pecos in New Mexico until a compact is reached, and said Texas is ready to take the question to the Supreme Court if necessary. The Texas legislature last year appropriated a substantial sum for court action to enforce Texas' demands for Pecos River water.

Bliss declared the Texas demands were much too high, and would place the full burden of river conditions on the state of New Mexico. He said the Texas demand for 293,400 acre-ft. of water annually represents an increase of 43,400 acre-ft. over the amount that actually would have passed the state line annually since 1905, under river conditions as they were in 1947.

TIGHT
BOU

OBITUARY

Harry L. Nickerson, 65, chief engineer of the Brooklyn Union Gas Co., N. Y., since 1940, died March 25. A graduate of Yale 1905, he later studied at M.I.T., and started as a laboratory assistant and testing engineer for the Peoples Gas Co., Chicago, in 1906. The next year he went to the Boston, Mass., Consolidated Gas Co. as assistant superintendent, and later became superintendent. In 1925 Mr. Nickerson was appointed engineer of manufacture for the Brooklyn Union Gas Co.

Gregg D. Wolfe, 75, civil engineer with the Scioto Valley and Traction Co. and its successor, Ohio Midland Light and Power Co., for 45 years, died Feb. 14 in Columbus, Ohio.

Charles M. Hirschfelder, 65, former city engineer of Rochester, N. Y., died March 18 in Syracuse. He was a graduate of the University of Toronto. He designed many residences in Rochester and while city engineer erected the city's disposal plant.

Robert David Caney, former civil engineer for public schools at Seattle, Wash., died March 15 at Port Angeles, Wash. He was a civil engineering graduate of the University of Michigan, Ann Arbor.

Lawrence S. Ehrman, 66, retired

Michael Heister, 77, who designed many Washington, D. C., landmarks, died there March 20. His firm designed such buildings as the Labor Department, Lansburgh & Brother department store, the Roger Smith Hotel and the American Federation of Labor Building. Earlier, he also designed many state buildings in the South.

Douglas W. Holton, 74, retired superintendent of the District of Columbia water department, died March 19 in Washington, D. C. After graduation from Vermont State University in 1898, he joined the district sewer department as an engineer and a year later was transferred to the water department. He retired in 1941.

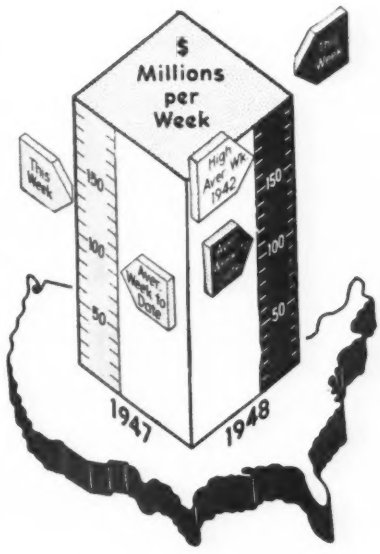
Frederick M. Cronin, 62, formerly an engineer with the New York State Department of Public Works, died March 19 in Saranac Lake, N. Y.

Prof. Sybren R. Tymstra, 64, a member of the engineering faculty at the University of Washington since 1929, died March 23 at Seattle. Born in The Netherlands, he was graduated from Zwickau University, Germany, in 1905. He was employed by various engineering firms in Detroit and New York before joining the faculty.

Oscar W. Werwath, 67, founder and president of the Milwaukee School of Engineering, Milwaukee, Wis., died March 21.

Charles A. O'Quinn, 40, sanitary engineer of Madison County, Fla., died

CONSTRUCTION ACTIVITY



As Reported this week to . . .
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only (Thousands of Dollars)

	Week of Apr. 1 1948	Cumulative 1948 (14 wks.)	Cumulative 1947 (14 wks.)
Federal	$31,266	$320,774	$108,369
State & Mun.	50,792	530,724	356,317
Total Public	$82,058	$851,498	$464,686
Total Private	136,726	791,980	853,952
U. S. Total.	**$218,784**	**$1,643,478**	**$1,318,638**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1948 (14 wks.)	Cumulative 1947 (14 wks.)
Waterworks ...	$1,914	$42,558	$29,545
Sewerage	3,481	44,398	22,010
Bridges	14,973	80,798	36,745
Highways	11,312	189,535	146,689
Earthwork, Waterways	3,432	147,813	52,724
Buildings, Public	43,669	291,829	124,726
Industrial ...	96,610	260,081	215,716
Commercial .	37,734	457,634	523,391
Unclassified ...	5,659	128,832	167,092

NOTE: Minimum size projects included are: Waterworks and waterway projects, $28,000; other public works, $50,000; industrial buildings, $68,000; other buildings, $250,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1948 (14 wks.)	Cumulative 1947 (14 wks.)
NON-FEDERAL	$875,582	$451,533
Corporate Securities	499,834	184,438
State and Municipal	375,748	267,095
**Total Capital ..... **	**$875,582**	**$451,533**

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EDITORIALS

VOLUME 140 NUMBER 14

April 1, 1948

Anticipating Right-of-Way Needs

MOVING BUILDINGS back from highways that are being widened is a costly operation that can be avoided in many future cases by proper zoning legislation. That is the view taken in Virginia where an active campaign is underway to keep new buildings from being erected within areas that are destined ultimately for highway purposes under a long-range development plan. Figures compiled by the highway department show that on 178 miles of new work in 50 typical rural counties, $528,000 was spent in moving buildings. This is nearly $3,000 per mile, and would be much more in the vicinity of towns and cities. Not only can such charges be avoided by proper zoning but, by keeping buildings back from the road, particularly at intersections, a major source of accidents can be eliminated. Virginia's efforts at zoning future rights-of-way, therefore, are doubly in the public interest.

New Fields of Activity

CONSTRUCTION is never static for any great length of time. New methods, new materials or new fields of activity keep the construction men who seek the advantage that comes from being ahead of the crowd always on their toes. During the war, some of the country's ablest builders found themselves called upon to undertake, in the greatest secrecy, construction of great manufacturing plants, the like of which they had not seen before. Later, these were revealed as plants for the production of fissionable materials for atomic bombs. At first it seemed that this was just another passing phase of war construction, but now it appears that these plants are not only a permanent part of the industrial scene, but that they may well be the forerunners of many other great plants for peace-time production of atomic power. Here would be a new field in which construction know-how will pay dividends, and another would be in the construction of plants for the production of fuel oil and gasoline from coal, oil shale or natural gas (*ENR* March 11, vol. p. 383). The synthetic fuel pilot plants presently proposed do not run high in dollar volume, but there appears to be good reason to believe that a large amount of construction will be needed ultimately, hence the importance of keeping in touch with current work to know what the special requirements of this new field may be. That fact gives special significance to a development that at first glance might appear to be outside the field of civil engineering activity. There are other similar developments, which points up the broadening interest in everything new that must be the stock-in-trade of today's engineers and construction men.

Aid For Clean Waters

IMPORTANT NEW SUPPORT is being developed in the campaign for stream-pollution abatement. Through its 16,500 local units, the General Federation of Women's Clubs has set into motion a nationwide educational program on the subject, following a regional conference at Philadelphia a few weeks ago where delegates from seven states were present. These leaders heard government officials and sanitary engineers describe stream pollution, outline practical measures to prevent it, and tell how women's clubs can campaign for industrial-and municipal-waste treatment. Visually, the group was exposed to the problem of stream pollution through the medium of the General Electric Co. film "Clean Waters." Factually, each delegate was fortified with educational pamphlets that will provide the ammunition for local-action programs. One pamphlet graphically outlines the nature, extent and cost of stream pollution and tells how persistent publicity and thorough organization brought about needed waste-disposal in several cases. The other booklet gives practical suggestions for conducting local meetings to acquaint the public with the health and economic hazards of stream pollution. With these effective publicity tools in the hands of a progressive national organization, the engineering profession should gain some well-deserved and necessary support for implementing corrective measures in stream-pollution abatement.

Opportunity for Public Service

ENGINEERS AND ARCHITECTS interested in serving their communities may find an excellent opportunity in the hospital survey and construction program administered by the U. S. Public Health Service. Under the Hospital Survey and Construction Act of 1946, Congress has authorized grants to the

tes covering one-third of the cost of a $1,125,000,000 construction program over a five-year riod (*ENR* June 12, 1947, vol. p. 919). To alify, a state designates an agency to conduct rveys and planning, and provides for an advisory uncil including hospital experts and consumer presentatives. It is expected that, within a state, ans will call for base areas, each with a large spital, serving several intermediate areas having naller general hospitals. Each of these in turn ill serve neighboring rural areas with more mited facilities. Thus, it is left to each community to determine its hospital needs and to bring plans to fruition. For this purpose, a hospital uncil may be formed. And it is on these councils, as well as on the state councils, that engineers d architects may perform a valuable public rvice. In these times particularly the need is great r men with an understanding of building construction and costs.

Teamwork That Pays

Two MEN representative of different but complementary elements of the American construction industry were singled out for the high achievement ward of The Moles a month ago. Although basically an organization representative of the heavy onstruction industry in the New York metropolitan egion, The Moles have a rightful claim to ational character by virtue of the far-flung activies of the members. As a result their annual wards have a similar comprehensive scope and mportance. The men who have received these wards since their establishment in 1941 are outtanding practitioners of the art, whose skill, ntegrity and accomplishments have been proved ver the years.

The award winners this year merited the honor n highest degree. Lieut. Gen. Raymond A. Wheeler, Chief of Engineers, U. S. Army, and William A. Durkin, president, Walsh Construction Co., are not only individuals of top stature, but they head and personify organizations that have made America great by joint endeavor and teamwork both in peace and in war.

The ability of the Corps of Engineers to marshall the talents of the construction industry so completely and effectively on war tasks was one of the important keys to the success with which American industry was put on a war basis so quickly. In referring to this accomplishment as an example of fine teamwork, General Wheeler emphasized that the team was not quickly created, but that it had been in existence and under perfection during many peacetime years.

Through our practice of providing, in river and harbor work, a practical-experience training ground in construction for our military engineers, these men know intimately the industry, its methods, business procedures and personnel. They are familiar with the capabilities of various specialists and can select them with knowledge and confidence. Only recently, through pre-contract conferences with prospective bidders on big jobs, they have instituted a procedure that promises to enhance this knowledge, aid the contractor and secure better bids. Giving the Army Engineers responsibility for one segment of civilian construction is a sound theory that not only works in peacetime, but has paid off in two recent wars. And it is to the credit of the Corps of Engineers that they have embraced the opportunity and yet have not exploited it to the extent of building up a huge construction organization of their own, which organization would have reduced our resources in the form of skilled private contracting organizations.

Another reason why this engineer-contractor team has proved effective rests with the contracting fraternity itself. Intense pride, coupled with boldness over the years in always attempting to execute something different and often bigger, has kept the art virile and progressive. Mr. Durkin revealed a cause for this when he said, "So long as one has to work at something, construction offers the most interesting, fascinating and satisfactory job in the world." When a lot of people feel that way, and try to make money at it in an intensely competitive atmosphere, progress is certain. And when a contract-letting agency, such as the Corps of Engineers, has the same desire for results and progress, mutual understanding and effective teamwork are bound to develop.

The teamwork between the Corps of Engineers and the contractors has paid off so well in the past that its continued existence is one of our best forms of insurance for a future that may again require out utmost in military-civilian cooperation.

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WALDO G. BOWMAN, *Editor*, EDWARD J. CLEARY, *Executive Editor*
New York: V. T. BOUGHTON, H. W. HUNT, E. E. HALMOS JR., T. D. MacGREGOR, F. S. MERRITT and JOHN C. BUMSTEAD, *Chicago:* V. B. SMITH
Cleveland: J. R. CARR, *Washington:* A. N. CARTER, *San Francisco:* N. A. BOWERS, L. L. WISE
EDITORIAL OFFICES: 330 WEST FORTY-SECOND STREET, NEW YORK, N. Y.

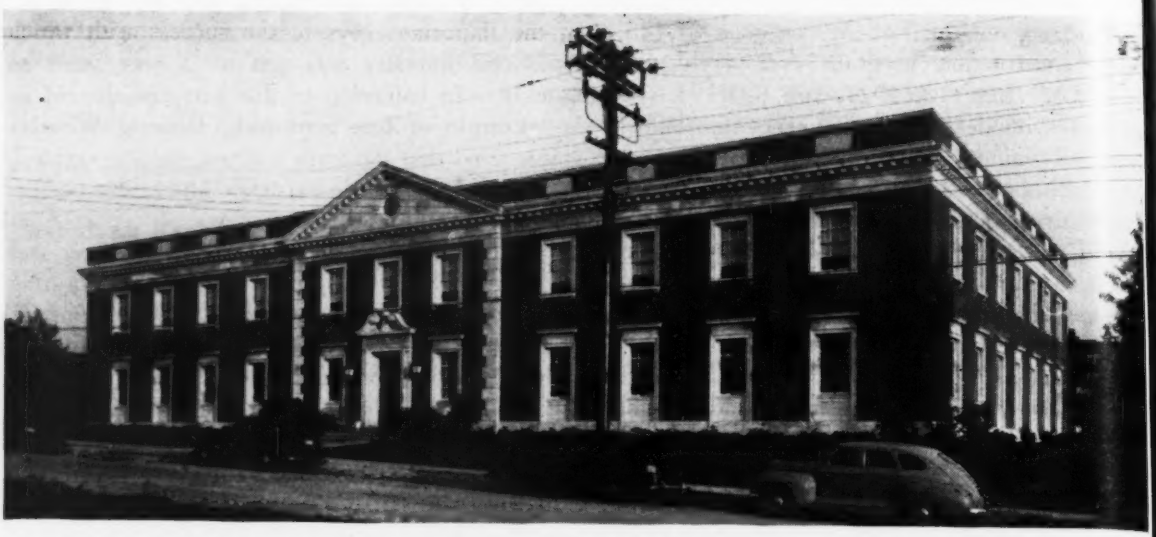


Fig. 1. A style in harmony with its location in a residential district was adopted for the telephone building.

A Telephone Office of Efficient Layout

J. G. Jory,
General Engineer,
The Chesapeake and Potomac Telephone Co.,
Washington, D. C.

***Contents in Brief**—To provide space for four dial telephone units, a two-story with basement building featuring a special cantilevered steel framing was constructed in the District of Columbia. The 103x162-ft. building is laid out to reduce travel between floors to a minimum, work spaces for women employees being grouped on the first floor. Maximum comfort for all employees is provided by air conditioning.*

A COMPLETELY air-conditioned large central office building for housing dial telephone equipment was recently completed in Washington, D. C., by the Chesapeake and Potomac Telephone Co., making it one of the first air-conditioned structures for this purpose. Design of the building is further distinguished by the special attention given to the comfort of the employees working in the building. Construction was expedited by use of an architect-owner-contractor control committee.

A building to house four dial units and of a design permitting future expansion if this proves desirable was required. Final choice was for a two-story walk-up steel-frame building with full basement. The building has a brick exterior with a frontage of 162 ft. and a depth of 103 ft. By adding 40 ft. to the depth of the structure two additional dial units can be installed. Also, the design used will permit a third floor to be added if this proves necessary.

Many years ago, a swampy stream ran diagonally across the construction site at a level much lower than the present grade. Although nine of the footings could be supported on the firm original earth where the building extended into the old bank, most of the footings had to be supported on steel-shell piles driven through the fill deposited on the reminder of the site. The piles were driven to a 30-ton bearing resistance and filled with concrete, a total of 436 piles varying in length from 15 to 48 ft. and all of 10-in. minimum diameter being required.

Since the building is located in a residential area, special attention was given to the appearance of the exterior of the structure (Fig. 1). Moreover, in view of the residential zoning limitations, the area occupied by the building is small compared to the total area of the site.

In making the detailed layout maximum attention was given to those features that would provide comfort and pleasant working conditions for the operating personnel. Also, the general layout was planned to reduce to a minimum travel of personnel between floors.

The west end of the basement is devoted to a 14 x 103-ft. cable vault, the underground telephone cables entering at one end of this vault. Adjacent to the vault is located a power room containing the main electric switchboard with equipment to transfer from an outside power source to emergency power, when this proves necessary. In a separate room are located the diesel-powered generators used as a source of emergency power, while the air-conditioning equipment was placed nearby. Rest rooms, toilets and showers for male employees

are also located in the basement.

On the first floor the main distributing telephone equipment occupies the west end, which permits the cables from the vault to be run upward to the distributing frame in this area. In the central part of this floor are located the operating room and the test bureau. Rest rooms and locker facilities for the women operators are also located on this floor, as is a cafeteria equipped to serve complete meals.

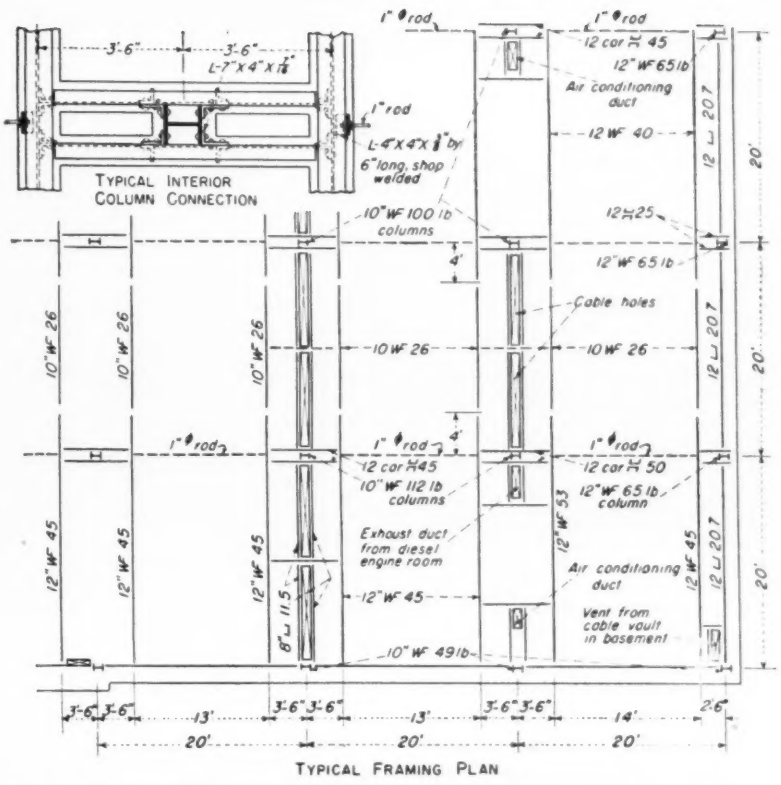
Almost the entire second floor is occupied by dial equipment in one large room. Only a few employees, mostly men, will be required on this floor. With this arrangement the female personnel will seldom need to leave the first floor, since their work areas, rest rooms, and the cafeteria are located at this level.

Special steel framing

The steel frames supporting the reinforced concrete floor slabs are of a special cantilevered type illustrated by Fig. 2. This special type of floor system was developed particularly for telephone buildings and has been used in a number of them in past years. Recently, improvements have been developed and patents covering design have been applied for.

With this type of framing the vertical air-conditioning ducts and telephone cables are located in the line of the columns (Fig. 3). This design was selected because with the conventional beam and girder construction such a procedure would not have been possible and a greater floor to floor height would have been required. The columns are spaced on 20-ft. centers in both directions, which provides an economical arrangement of the dial equipment frames, and the columns vary in size from 10-in., 49-lb. WF sections to 12-in., 112-lb. members.

Where the heavy lead-sheathed telephone cables are brought into the building from the underground conduits into the cable vault and supported on racks in the vault, it is necessary to provide for large radius bends. Therefore, to provide the maximum headroom to make the bends, the ceiling over the vault was constructed as slabs cantilevered outward from the side walls of the vault which allowed a continuous slot to be provided in the ceiling. The cables pass from the vault through this slot to the floor above.


TYPICAL INTERIOR COLUMN CONNECTION
L-7"X4"X⅞"
L-4"X4"X⅜" by 6" long, shop welded
1" ϕ rod
12 cor H 45
12" WF 65 lb
Air conditioning duct
12 WF 40
12 ⌊ 20.7
10" WF 100 lb columns
12 H 25
10 WF 26
Cable holes
12" WF 65 lb
12 cor H 50
10" WF 112 lb columns
12" WF 65 lb column
12" WF 53
Exhaust duct from diesel engine room
12" WF 45
6" ⌊ 11.5
Vent from cable vault in basement
10" WF 49 lb
3'-6" 3'-6" 13' 3'-6" 3'-6" 13' 3'-6" 3'-6" 14' 2'-6"
20' 20' 20'
TYPICAL FRAMING PLAN

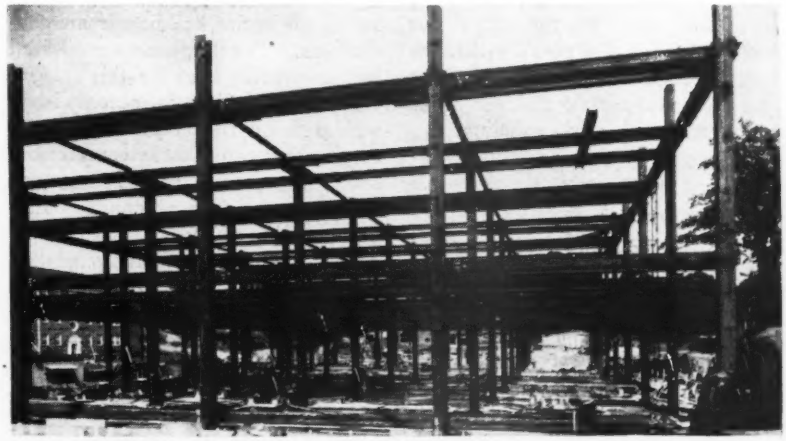


Fig. 2. A portion of the framing for the second floor is shown at the top. Typical of the entire structure, the framing consists of dual steel beams supported on cantilevers attached to the columns.

Above grade the exterior walls consist of 13 in. of brick, 2 in. of glass insulation, and 4 in. of hollow tile with an interior finish of plaster. This type of wall was selected for its high insulation value. The windows are of a double-hung, steel-sash type designed to meet the automatic closing requirement of the Fire Underwriters recommendations.

Interior finish of the building received special attention to assure pleasant working conditions as well as long-life with low maintenance costs. In the front lobby a marble wainscot and terrazzo floor are used. For the single stair well, which is located at one side of the lobby, a satin glazed tile wainscot was specified with the stair treads of reinforced hard rubber containing an abrasive aggregate.

Linoleum surfacing is provided on the floors in the operating rooms and

Fig. 3. The cantilevered framing permits ducts for the cables and air-conditioning system to be carried upward along columns and between the dual floorbeams.

hallways, while asphalt tile of grease-resistant type is used in the power room and neighboring areas. For the kitchen, gloss-glazed tile walls and non-slip mosaic tile floors were selected. In the toilets the walls are of similar construction, but terrazzo floors are used. In the large rest room adjoining the men's toilet, the floor is surfaced with grease-resistant type asphalt flooring and the walls are covered with wood paneling.

In the equipment areas the concrete floor slab forming the ceiling is left exposed, but it is painted, as are the plaster wall surfaces in these rooms. For most of the remainder of the building suspended ceilings surfaced with acoustical tile and flush-type fluorescent lighting fixtures are generally used. The color scheme for all areas received special attention to assure warm bright colors for the operating room and cafeteria and restful colors in the lounges. Rooms of pleasing appearance resulted.

All deliveries of supplies are made by truck at the rear of the building, where a paved driveway is provided. Openings are available in the rear wall at each floor level. These entrances are equipped with double doors hinged to open back against the inside face of the wall to leave a clear opening. Any telephone equipment, which arrives generally in the form of large factory built units, can be hoisted directly from the trucks into the equipment entrances. Permanent outriggers of a type that can be extended out through the parapet when needed and moved back over the roof are provided above these entrances.

Building entirely air-conditioned

With the exception of the boiler room, the entire building is air conditioned. Two low-pressure oil-fired boilers provide heat for this system, while the cooling is accomplished with a freon refrigerating plant incorporating two 100-ton compressors and evaporative condensers, one compressor being a standby unit. The equipment is of sufficient capacity to carry future enlargements.

All of the fresh air supply is cleaned by electrostatic filters, as is the recirculated air. The amount of fresh air added in the rooms where most of the personnel are concentrated is equivalent to one change each 40 min., and in the equipment space the fresh air equivalent is one complete change each 2 hr. The quantity of new and re-circulated air equals one change each 10 min.

Three systems for circulating the conditioned air are provided. One system accommodates all the rooms with individual temperature controls, including the operating room, the cafeteria, the rest rooms, and the offices on the first and second floors. The second system handles the rest of the space on the first floor, the basement, and the equipment area at the west end of the second floor. The equipment area at the east end of the second floor is supplied by the third system. Aluminum ducts with the horizontal runs exposed in the equipment areas are used for all three systems.

The air-conditioning machinery was selected to maintain a temperature of 80 deg. F. dry bulb and 50 percent relative humidity when the outside temperature is 95 deg. F. dry bulb and 78 deg. wet bulb. The facilities are also planned to provide 70 deg. F. dry bulb when the outside temperature is zero. Pneumatic temperature and humidity controls are used to maintain interior atmospheric conditions.

In addition to providing for comfortable working quarters by incorporating air-conditioning facilities, showers are provided adjacent to the toilets for male and female employees and a tile-floored sun bathing deck is provided on the roof.

Special team expedites work

Because construction was scheduled to start early in 1946 at a time when many materials were in short supply, a special three-man control committee was established to expedite construction. This team consisted of Ray L. Olson, architectural engineer, representing the owner, Leon Chatelain, Jr., the architect, and John G. Scharf, representing the Prescott Construction Co., the general contractor. This committee functioned during the planning and design stage as well as during the period of actual construction.

By close cooperation of these three men during the entire job, much valuable time was saved. For example, as the building was being planned, the contractor provided information as to the availability of proposed materials. This information enabled the architect to select materials that could be purchased more readily. At various stages the control committee called in advisers, but it made all major decisions.

Frank N. Kneas, Philadelphia, was consulting engineer on the structural framing, and Wm. K. Karsunky, Washington, consultant on the mechanical and electrical work. For the Prescott firm Frank Smart was superintendent. Mr. Olson, assisted by the author, was in charge of construction for the Chesapeake and Potomac Telephone Co.

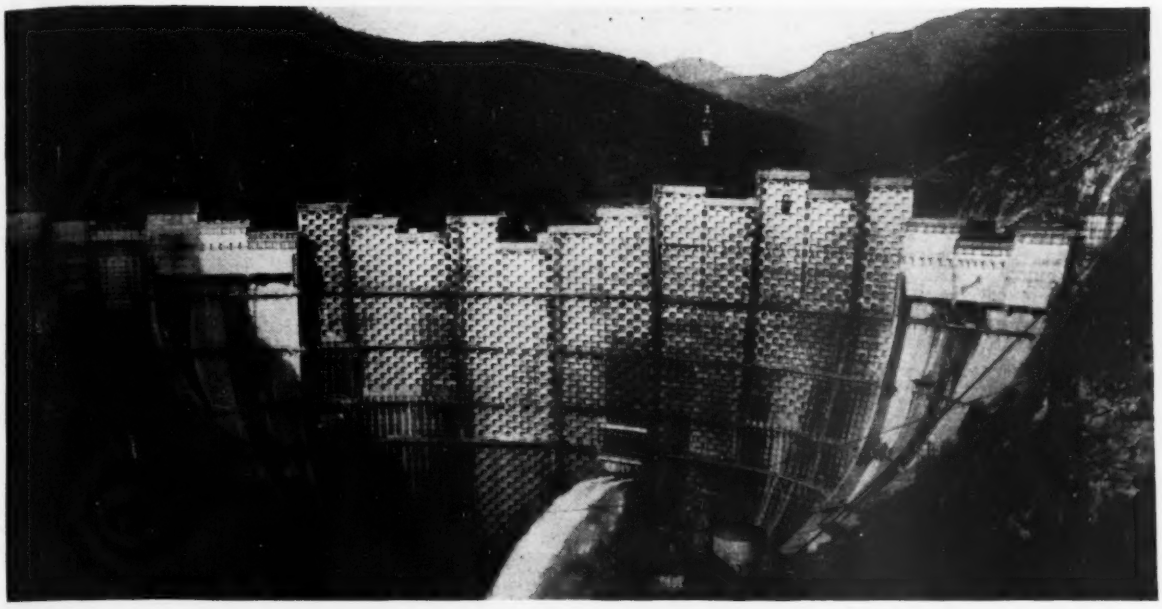


Fig. 1. Composite photo of full downstream face of Ross Dam. Indentations will provide bond when dam is made thicker.

Ross Dam Third Step Nears Completion

Contents in Brief—Completion of the third step in the construction of Ross Dam on the Skagit River for the city of Seattle is expected in 1948. Work on the second step, started during the war to assure a power supply in the Pacific Northwest, was continued in 1947 without a halt right into the third step while a contract was being negotiated. Recent design changes are noted as are future plans for power development on the Skagit.

COMPLETION of the third step in the stage construction of Ross Dam on the Skagit River in Washington is scheduled for this year. At that time there will remain only the fourth and last step required to bring the dam to its full height of 675 ft., completion of the power tunnels, and construction of the power plant. At present the dam is being used to store water for the two other plants of the Seattle Department of Lighting farther downstream (*ENR* Oct. 12, 1939, vol. p. 460; Sept. 20, 1945, vol. p. 378).

The base of the dam is at El. 1075; step one carried the top to El. 1365; and step two called for the top to be at El. 1550 with the spillway crest at El. 1525. Step three will bring the spillway crest to El. 1582 with radial gates bringing the maximum reservoir level to El. 1600. As now planned, the fourth step will bring the top to El. 1750 (spillway crest—El. 1725). In anticipation of the additional thickness required by the fourth step, indentations were formed in the downstream face to increase the bond.

Original plans called for only three steps, the third step to add thickness and raise the top from El. 1515 to El. 1728. But such good concrete was produced in the initial work that higher stresses could be used, thus making it possible to raise the second step from El. 1515 to El. 1550 and to insert a new step, now called the third step, which would carry the spillway level to El. 1612 (top at El. 1650) without thickening the base. However, the Federal Power Commission would only approve water storage up to El. 1600 without additional thickness, and this level is now being used for the crest gates for the third step. The temporary roadway over the top of the dam at this stage will be at El. 1615. This third step, with reservoir level at El. 1600, will add 724,000 acre-ft. to the capacity, bringing the total at that level to 1,400,000 acre-ft.

Second step started before war

A contract for the second step was let in 1943 on request from the federal government to assure an increasing supply of power for wartime activities, but because of difficulty of access to the site, work did not get fully under way until 1945. It was still in progress at the close of the war when the city decided to go ahead with the third stage in view of the increased power demand. At that time the contractor for the second stage work, General-Shea-Morrison, had $1,500,000 of construction plant at the site, hence negotiations for completion of the third stage of the work were begun with that organization. They resulted in a bid of

$5,298,965, which was approved by a board of engineers consisting of General Thomas M. Robins, retired Chief of Engineers, U. S. Army, C. D. Pollock, consulting engineer, Seattle, and L. F. Harza, consulting engineer, Chicago, as being in line with the current increases in construction costs. Accordingly, the contract was let last year to General-Shea-Morrison with no work stoppage.

Second step specifications called for the dam to be finished off at El. 1550, with the spillway crest at El. 1525. As it was planned to wait a number of years before starting work on the third step, all blocks were to be finished off and a foot bridge was to have been built across each spillway. This and other second step finish work was not carried out. Concrete was poured in some third step blocks before other blocks were up to second step finish elevation.

Progress on the third stage

Forming the spillway crests and deflectors has proved to be a serious bottleneck in the current work. The deflectors are designed to keep water spilling over the crest from spraying free of the spillway (*ENR* Sept. 20, 1945, vol. p. 379). As the proper functioning of these spillways is dependent in large measure on the accuracy of the form work, much careful form work was required for each 5-ft. lift. Consequently, two or three times as much time was required to set forms and reinforcing steel in the spillway blocks as in the other blocks. In a typical 5-ft. lift on the spillway sections, 60 survey points were required.

In pouring operations, maximum elevation difference allowed between adjoining blocks was 30 ft. or six lifts (specifications limit was 20 ft. but additional leeway was allowed in a few sections). Thus, because of the slowness of spillway work, some blocks were not poured as fast as desired. This can be clearly seen in Fig. 2 where the maximum differential exists between the outer two of the three spillway blocks in the foreground and the adjoining regular blocks.

The excellent quality of the Ross Dam concrete can be attributed to good aggregate, close supervision of mixing and pouring operations and design of mixes to combine the various elements to best advantage. Cores taken from step one for Class A concrete (1 bbl. of cement per cu. yd.) tested from about 5,500 to 7,200 psi. in compression and for Class B Concrete 1.3 bbl. of cement per cu. yd.) from about 6,000 to 11,500 psi.

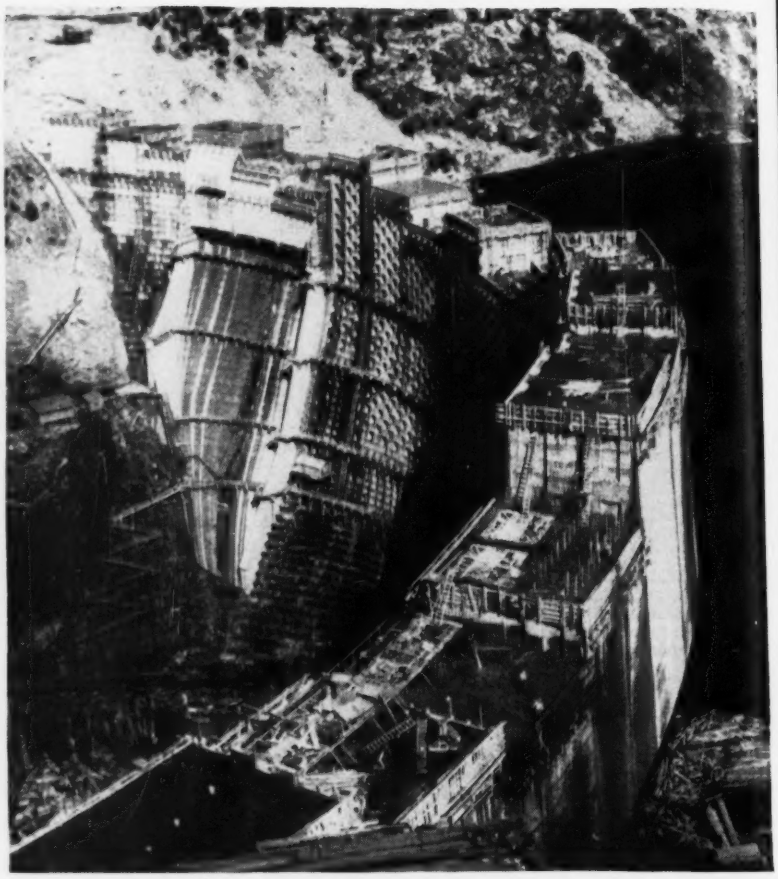


Fig. 2. In the foreground, forms have been set in three blocks for the sluiceways of a spillway similar to the one shown at the other end of the dam.

Four grades of concrete were used in the dam, namely, Classes A, B, B-Spillway and C. Class A was used in the massive portions of the dam; B, a richer mix, in the first 6 ft. of the upstream face of the dam; B-Spillway, a still richer mix with no cobbles, in the downstream face of the spillway; and C, which was a higher water-cement ratio than B-Spillway, in the deflector hoods.

Discharges from the reservoir

Two spillways are being provided, one on each side of the dam. Their lower ends are curved in such a manner that when they are discharging large quantities of water the two streams impinge for the destruction of their energy.

The spillway gates will be of the radial type as such gates are cheap and require little maintenance. The 15 ft. between the top of the gates and the roadway is provided in order to permit room for the gates to swing open and to allow space for the gates to be cleaned and painted when in the raised position.

Spillway capacity is 127,000 cfs.—with gates full open. Supplementing this are four valves with a total capacity of 10,100 cfs. The two valves seen discharging in Fig. 1 are 72-in. Pelton butterfly valves. Normal daily flow for use in power plants down stream is handled by these valves. At the base of the dam just above the water level are two 72-in. Howell-Bunger valves. These are used during periods of high flow and during winter months when a greater flow is required for power generation.

Howell-Bunger valves are of the

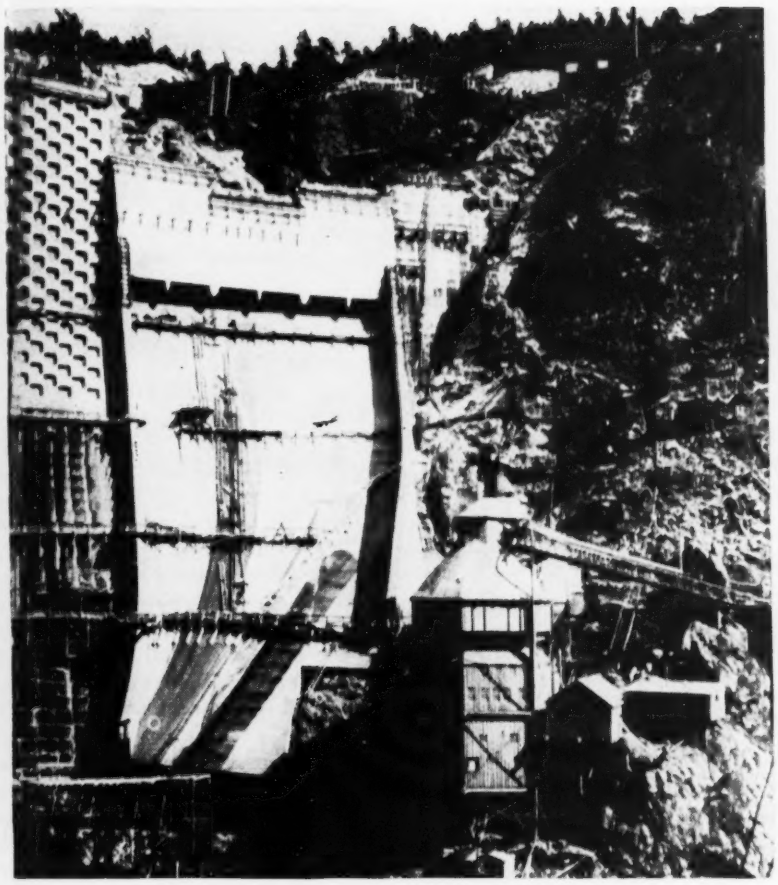


Fig. 4. The concrete plant clings to the side of the gorge. Part of it will have to be dismantled before this left-bank spillway can be completed.

conical type. To open the valve a cylindrical cover is withdrawn from a stationary cone. Amount of discharge can be varied to any desired degree and the energy of the water is effectively dissipated by the cone.

One disadvantage of this type of valve in locations subject to freezing weather is that the fine spray set up in the process of energy dissipation coats everything in the vicinity with ice, making operations extremely hazardous. To overcome this objection, a special hood was designed to restrict the spray on the Ross Dam installation. This hood is located 7 1/3 ft. from the valves and in tests to date appears to be suitable for its purpose. Results, however, are not conclusive.

The two Howell-Bunger valves are centered at El. 1216, with level of the downstream reservoir being at El. 1205. With Ross Reservoir at El. 1500 they can discharge 5,000 cfs. and at El. 1600, 5,900 cfs.

The next phase of construction after completion of the third step of Ross Dam will consist of completion of the power tunnel, construction of the powerhouse and installation of four 90,000-kw. generating units. Facilities for power transmission to Seattle will also be provided.

The increase in reservoir capacity provided by Ross Dam with the third step completed will firm up the water supply and allow additional generating capacity to be installed at the existing Gorge plant, 12 miles downstream. Preliminary engineering is now under way on a program which will by 1950 increase the capacity of this plant to 90,000 kw. by adding one unit capable of producing 40,000 kw. under present head conditions.

Further development of the Gorge plant will include the construction of a dam at the intake, increasing the head on the plant some 100 ft. This will bring this plant's capacity up to 135,000 kw. and no new units will be required. This dam is expected to cost some $8,000,000 and it will replace a low diversion dam.

The fourth and final step of Ross Dam will consist of placing additional concrete on the downstream face of the dam and increasing the height of the structure to El. 1750 ft. The resulting reservoir will impound 3,450,000 acre-ft. of water with the maximum water level at El. 1725 ft. It is probable that this construction will not be undertaken until after more economical power developments in the Northwest region have been completed.

Superintendent for the Light Department is E. R. Hoffman; W. C. Snow is assistant superintendent; J. L. Savage is consulting engineer; Ross Dam project engineer is W. B. Wolfendale; designing engineer for the Light Department is E. R. Schindler. Resident engineer at the dam since the retirement of H. F. Faulkner in August, 1947, is C. E. Shevling. He is assisted by H. M. Lees, concrete technician, and R. P. Sonntag, assistant resident engineer.

The contract is held by General-Shea-Morrison, a combination of the General Construction Co., J. F. Shea Construction Co., and Morrison-Knudsen, Inc. Ted Harris is superintendent at the dam.

TABLE I—CONCRETE MIX PROPORTIONS (4-cu. yd. batch)

Ingredient	Size—in. Max.	Size—in. Min.	A	B	B-Spillway	C
Cement (lb.)	....	....	1504	1955	2105	2105
Sand (lb.)*	....	....	4435	4040	4935	4935
Pea Gravel (lb.)*	¾	⅜	2600	2700	3470	3470
Medium Gravel (lb.)*	1½	¾	2700	2370	3740	3740
Coarse Gravel (lb.)	3	1½	2800	2750	2000	2000
Cobbles (lb.)	6	3	2650	2725	....	....
Water-Cement Ratio	....	....	.53–.57	.43–.47	.45–.48	.47–.50
Slump (in.)	....	....	1–2	1¾–2½	2½–3½	3½–4½

* Based on 5% moisture content in sand and 2% in pea gravel and 1% in medium gravel.

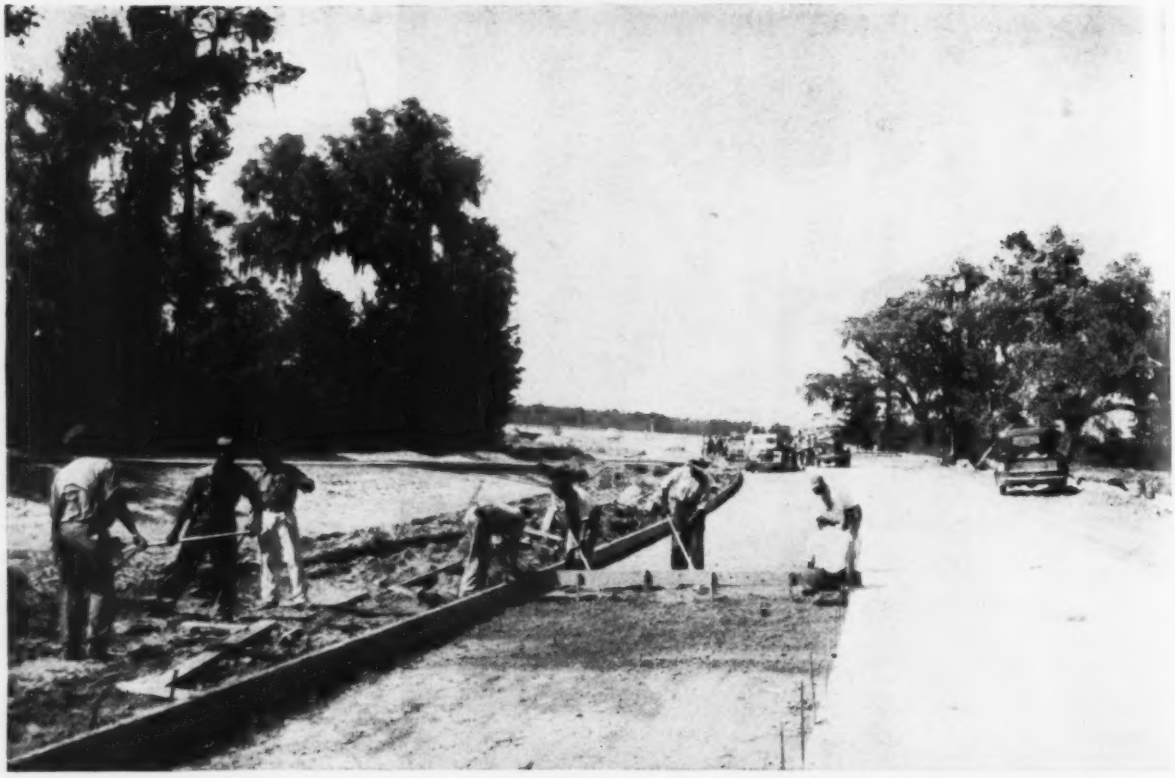


Fig. 1. On some curves the old alignment was abandoned and an entirely new superelevated roadway 24 ft. wide built.

Georgia Improves the Coastal Highway

Contents in Brief—To improve the Coastal Highway, the Georgia Highway Department has replaced badly damaged areas of the old plain concrete slab and increased the roadway's width from 18 to 24 feet. On tangents the old slab was widened by addition of 3 ft. of new concrete at either side, but on the curves, which were spiralled, the increased width was added on the inside of the curves. Also, all the curves were superelevated by making a thicker application of asphaltic concrete to the outside edge of the roadway when the asphaltic material was applied over both the old and new concrete.

MUCH CONSTRUCTION has already been done and considerable work is planned for later award to improve the Coastal Highway in Georgia (U. S. Route 17). When all the work scheduled is completed, this highway, which is Georgia's second most heavily traveled road, will have greatly improved riding qualities and it will be much safer to travel.

South of the city of Savannah one long improvement project was completed in 1946. North of Darien a second job 23 miles long was finished late in 1947.

Operations on this latter job were typical of the methods being used. All badly damaged areas of the old plain concrete pavement, which consisted of a 9-6-9-in. slab built about 1925, were replaced with new concrete and the width of the old roadway increased from 18 to 24 ft. At locations where the pavement was cracked somewhat but not sufficiently damaged to require its removal, the thickness of the base of the asphaltic concrete later added over both the old and new slab was increased by from 3 to 4 inches to provide extra strength at these points.

In the widening work, a 3-ft. strip was added at either side on tangents, but the curves were spiralled and at these points most of the increased width added on the inside of the curve. All the new concrete was made 7 in. thick and a mix designed to give a 3,000-psi. minimum compressive strength at 28 days was specified. High-early-strength concrete was used to speed up the work and to reduce possible damage to the new concrete from traffic as the road was kept open to traffic during all operations. The typical mix was as follows:

Cement	940 lb.
Coarse granite aggregate	4,534 lb.
Sand	2,191 lb.
Water	52 gal.

Maximum size of the coarse aggre-

gate was limited to 2-in. dia. material.

The trenches at the side of the old slab for the new concrete were prepared with a motorized grader. In this work, a blade of standard length was used, which made the excavation of sufficient width to permit erection of conventional steel forms for the outer edge of the new concrete.

One lane kept open

To permit traffic to continue to use the highway, one side of the road was improved while traffic used the other lane with the aid of flagmen. The hazard to traffic of the open ditches for the new concrete was further reduced by not excavating more than ¼ mi. ahead of the crew placing the concrete. The latter was delivered by truck-mounted mixers, and on some days as much as one half-mile of the 3-ft. extra width along one side was built. The crew for this work usually consists of about 40 workmen.

Spreading and finishing of the new concrete was accomplished with hand tools. At the outer edge of the new concrete a header 6 in. wide and 2½ in. high was provided. This header was planned to prevent ravelling of the 2½-in. thickness of asphaltic concrete later applied over both the old and new pavements. The simplified forms used to permit speedy construction of the header are illustrated (Fig. 2).

Curves also superelevated

In addition to being spiralled, the curves were superelevated. This was accomplished in most instances by increasing the thickness of the asphaltic concrete on the outside of the curve. In calculating the required increased thickness, a design speed of 60 mph. was used.

At some curves it would have been necessary to increase the thickness of the asphaltic concrete over 12 in. at the outside edge of the pavement to provide adequate superelevation. Since increasing the thickness of the asphaltic concrete this much was considered undesirable, at these locations the old pavement was torn out and replaced with a new slab built with sufficient tranverse slope to provide the necessary superelevation. The new slabs were also made 7 in. thick and a 2½-in. header was provided at either side to confine the asphaltic concrete surfacing also used at these locations.

Fig. 2. Along the edge of the new concrete work a 2½ x 6-in. header was provided to prevent ravelling of the asphaltic concrete top added later. The inside form for the curb consisted of a 2 x 6-in. timber secured to the steel forms by wood ties of the type illustrated.

No reinforcing steel was specified for the new slabs, but tie bars were installed along the longitudinal joint on 42-in. centers. Contraction joints were also eliminated.

Asphaltic concrete surfacing

In adding the asphaltic concrete top over the old and new pavements, a 1½-in. binder course followed by a ¾-in. wearing course was used. In addition, where the old pavement was cracked appreciably but not sufficiently to require its removal, a base course about 1½ in. thick was also used. Before the base was constructed, a tack coat consisting of RC2 asphalt was applied at a rate of 0.08 gal. per sq. yd. The tack coat was allowed to cure for at least a day before the binder course was constructed.

For the base course the aggregate consisted of 35 percent local sand and 65 percent crushed granite aggregate. This mixture must meet the following sieve analysis:

Sieve Size	Percent Passing
1½ in.	100
1¼ in.	100
¾ in.	80
No. 4	37
No. 200	2

The asphalt content for the base course averaged 5.25 percent, and cement of 85 to 100 penetration was used.

General procedure was to pave one lane at a time for a considerable distance and then go back and pave the other side, which caused less interference to traffic. The base mix arrived on the job at a temperature of about 300 deg. F. Rolling was with a 10-ton tandem-wheel roller.

Addition of the binder course followed about five miles behind con-

struction of the base course. In this work the aggregate consisted of 25 percent local sand and 75 percent crushed granite rock. The mixed aggregate had to meet the following specifications:

Sieve Size	Percent Passing
1½ in.	100
1¼ in.	95
¾ in.	75
½ in.	60
No. 4	27
No. 10	26

The average asphalt content of the binder course was 4.75 percent, a cement of 85 to 100 penetration being used. The binder was put down at about the same temperature as the base. Rolling was with the same equipment as for the base course.

Addition of a top classed as Topeka Pavement Type 1 completed the paving operation for a given section. Because as much as 5 miles of the binder was built before the top was put down, a tack coat of 0.08 gal. of RC-2 was also used between these two courses. The crushed stone aggregate for the top was proportioned as follows:

Sieve Size	Percent Passing
½ in.	100
⅜ in.	98
No. 4	74
No. 10	43
No. 30	33
No. 80	15
No. 200	7

The bitumen content for the top averaged slightly over 7 percent of cement of 85 to 100 penetration. This course was put down at a temperature of 300 deg. F. in much the same manner as the base and binder.

For the 23.4-mi. project, the asphaltic surfacing totalled about 329,500 sq. yd. Asphaltic concrete requirement for the base totalled 16,000 tons, for the binder 32,400 tons, and for the top course 18,400 tons.

Production of the asphaltic concrete was distinguished by use of a mixer built in 1941 and mounted on railroad cars. The plant had a capacity of 1,500 tons per 12-hr. day. It was mounted on three cars spotted on a siding three miles from the job.

Twin drying cylinders 40 ft. long and mounted side by side on a special car 70 ft. long were provided. Stone leaving the dryers was dumped into a single pit for delivery by a bucket elevator to a hopper at the front end of the second car and above the mixer.

Fig. 3. In constructing the asphaltic concrete top added over both the old and new pavements, it was thickened on the outside of curves to provide the desired superelevation, as at the near edge of the work illustrated.

On the third car was located the 120-hp. diesel engine providing power for the mixing drum and the hot-asphalt elevator. A second diesel unit provided power for feeding the bins ahead of the dryers, and a third unit supplied power for the fans drawing the hot gases through the dryers.

Steam for the plant was furnished by an 80-hp. coal-fired boiler erected adjacent to the siding. The plant was so designed that when the equipment is moved it is only necessary to dismantle the loading bin at the front end of the dryers, the hot asphalt elevator, the loading hopper at the rear of the plant, and the boiler plant supplying steam. Five railroad cars, including the three on which the plant is mounted, are sufficient to transport the entire plant.

Shoulders are widened

As a last operation in improving the highway, the shoulders at either side were increased in width to 10 ft. In this work borrow material delivered by truck was used.

Results of the work to date have been so successful that plans are being prepared to improve 12 additional miles of the highway this year in a similar manner. This work is located between Brunswick and Darien.

All construction was by the Georgia State Highway Department with the assistance of the Public Roads Administration, which helped finance the work. For the department, W. R. Neel is state highway engineer, Sam P. Allison, construction engineer, J. O. Bacon, division engineer at Savannah, and E. M. Kennedy, resident engineer on the job.

The PRA was represented on the work by B. P. McWhorter, division engineer at Atlanta, J. T. Marshall, district engineer in Georgia, and L. Silas Moore and U. L. Fisher, field engineers.

S. J. Alexander, Thomasville, Ga., held the widening and paving contract. The grading work was done by the P and W Construction Co., Atlanta. Total cost of the 23-mile project was about $900,000.

Finding and Fighting Marine Borers

By Robert D. Chellis
Structural Engineer, Stone & Webster Engineering Corp.
Boston, Mass.

Part III—Metal Armor and Concrete Jacketing

Contents in Brief—Protecting the surface by charring, tarring, metal armor and mortar or concrete jacketing, have from the first been favored methods for protecting timber against attack by marine borers. Appraisal of the several methods show short life or spotty success. Failures have been due to poor materials or imperfect workmanship. Recent developments in the use of shotcrete and pressure concreting are promising more certain results. This is the third article in a series of four, the previous articles having appeared in the issues of March 4 and 18.

DETERMINATION of a method for protecting piles against marine borer attack calls for thought. Of first consideration is the type of structure, its expected economic life, the use to which it is to be put, the availability of protective materials and their cost. Decisions based on experience in other locations where marine borer attack is light may be unsafe. Short tests are misleading because several years may be needed to show the effectiveness of any proposed protection. Protection is generally more difficult in warmer waters.

In general, expert advice is desirable. When performing work in infested waters the services of a taxonomist should be secured. He may be able to predict whether or not danger is likely to occur in the future. He is familiar with the physical characteristics of borers, their habitats, breeding seasons, length of life, food supply, periods of activity, natural enemies, associated organisms, and cyclic variations, and thus is able to determine what method of protection will be most effective and economical.

Complete protection essential

Care in construction of the protective armor is vital. Marine borers are highly predatory. They are persistent in hunting openings in protective shells; and minute entrances are open doors to many of the most destructive types. The most common cause of failure of protective measures has been poor construction materials or workmanship.

Leaving bark on the piles has been advocated as a protection, but the bark must remain unbroken. *Limnoria* will enter through knots, hence all knots and abrasions must be covered with sheet metal or other coatings. Bark protection is of value only for temporary structures.

Packed fill will stop further damage if sufficient pile remains to justify it. Riprap seems to provide protection. Barnacles sometimes give considerable protection, although the presence of other marine organisms is indicative of suitable conditions for borers.

Untreated wood battens on creosoted piles are worse than useless. Fabric sheathing breaks easily during driving of the pile or from subsequent storms, which wash gravel or debris around the pile, and is not generally satisfactory.

Use of metal sheathing applied tightly to the timber was the earliest of protective measures if temporary coatings, such as charring the surface or smearing with tar, used by the ancients are excluded. It is written of ships sailing on voyages of discovery in the reign of Henry VI: "They cover a piece of the keeles of the shippe with thin sheets of leade, for they had heard that, in certain partes of the ocean a kind of wormes is bredde which many times pearceth and eateth through the strongest oake that is."

Metal armor in the form of sheets, wire, nails or other shape still is used for protection.

Sheet metal sheathing requires preparation of piles before driving. Knots and projections must be removed and the surface made as smooth as possible, then an even coating of asphalt-saturated felt or burlap should be applied, over which the metal is tightly nailed.

Precautions for metal armoring

Copper sheathing is subject to theft and abrasion. Zinc sheathing has not proved economical. Muntz, or "yellow" metal must be carefully checked to be sure that the alloy, consisting of about 40 percent zinc and 60 percent copper, is homogenous or else electrolytic action may be set up, as indicated by conflicting reports of service. Nails must be of the same composition as the sheet metal in which they are used.

Scupper-nailing with iron or steel has some merit where labor is cheap. It was used in ancient times, and is still used to some extent in Denmark and Germany. Copper nails have not been found to give much protection. Nails such as 3*d* or 4*d* spaced $\frac{1}{4}$ to $\frac{1}{2}$ in. apart, and 1 in. nails with $\frac{3}{8}$ to $\frac{1}{2}$ in. dia. heads using $\frac{1}{2}$ in. wire mesh as a template have been driven. Protection is given both by the nail heads and rust incrustation. Borers seem to have an aversion for the iron compounds formed in the wood. Scupper-nailing resists *Limnoria* better than *Teredo*, for *Limnoria* bores only about $\frac{1}{2}$ in. and in any spot damage is local, but if *Teredo* gains entrance

it penetrates deeply. Hoop iron and wire wrapping have been used, but their value has not been so well established.

Metal armor is not much used now. Iron or steel sheathing, unless of heavy gage, has a short life, and wiring, nailing and hooping are not generally practicable. In some cases sheet metal shells slipped over the pile and footed in the mud have been used, the space between pile and shell being filled with sand or concrete. Fig. 2 shows a recent construction. Metal armoring on the whole has given way to encasement with concrete.

Concrete encasement

Invention has been active in devising methods of concrete protection. Records of good service have been spotty. The failures can be traced mostly to poor material or to poor workmanship. It has required experience to show how insidious borer attack can be. Recent use of denser material and of pneumatically applied or pressure concrete should give better and more uniform results.

The history of concrete protection is long and only the outstanding developments are possible of mention. As long ago as 1895 "cylinders" of concrete to inclose cluster piles were used and are still in service. They were formed by driving three wood piles, lowering a steel plate form over them, seating it in the mud, pumping it dry and filling with concrete. In 1900, Holmes concrete cylinders, a similar construction, were developed. Wood stave forms bound with steel hoops were used and left in place to be destroyed by borers. The results were not too good because of poor concrete; mud and sand pockets due to failure to seal the bottom; arching of concrete; laitance pockets; excess water in the concrete; non-continuous pours; failure to carry the encasement far enough below the mud line to allow for scour, and lack of adequate reinforcement to prevent separation of parts when rupture occurred. As a result of this, the 3-pile type was abandoned. However, a gasket was developed to keep mud and water out of the bottom of the forms for the single-pile type, and excellent service was obtained. After 17 years only minor, repairable flaws were found.

Succeeding practice has held to single pile encasement, using forms,

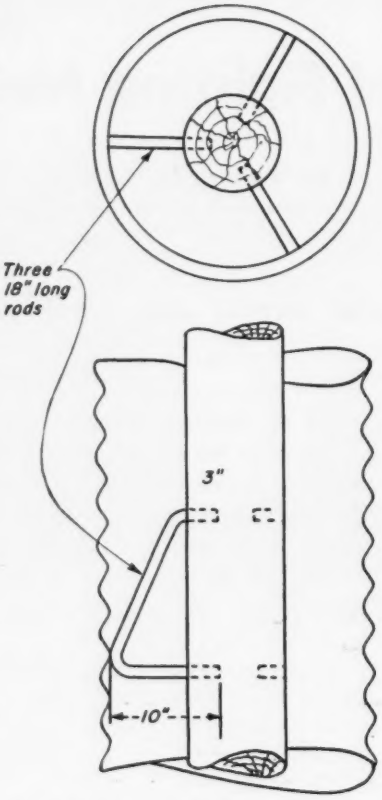


Fig. 2. Method of placing a corrugated shell over an under-water pile for concrete jacketing.

precast shells and concrete applied directly to the wood. Black's patent, used from 1908 to 1913, is notable as the forerunner of later removable sectional forms. The concrete was poured above water level in successively added sectional metal forms, each form being secured to the preceding, and all left in place. This was slower than the later type of hinged wooden forms. Results were not promising.

Removable wood forms were used in the later Camp process. Concrete was placed in tongue and groove wood stave forms 20½ in. in diameter and 3 ft. long, bound with iron hoops. Each section was divided in quarters and fastened with iron lock-wedges. The bottom of the first section was sealed with a gasket. The sections were filled in the dry and lowered successively, bolting them together. The form penetrated the mud. After two days the forms were removed by pulling a chain releasing the lock-wedges. The coatings were inspected by a pole hook, and larger casings lowered over bad spots to form patches.

The process is easily used for repair work. If the pile is not straight, or is out-of-plumb, there is danger of thin concrete on one side. If the mix is too dry, it may bind and form pockets which fill with sea water to the detriment of the concrete. The exposure at the mud line caused by pulling the casing may permit borer attack. Lack of reinforcement may be serious.

The Newsome-Squire process, introduced in 1921, consists of placing forms around a wood pile and pouring the concrete while driving the pile, thus securing vibration of the concrete.

Repairing damaged piles

Two processes developed perhaps primarily for repairing damaged piles but usable for new piles are the Hay and the Presscrete. The Hay process is a method of restoring damaged wood piling to full strength with concrete encasement. A patent form is designed to allow placing of concrete to any desired depth, even down and into the ground, and has been successful in 30 ft. of water. Concrete is mixed and placed in the watertight form suspended above water and lowered to the desired depth, where it is left until the concrete has set. The forms are then removed. If damage occurs only in the upper portion of a pile, this method need not be applied much below the damaged parts. The method is controlled by the Cement Gun Co., Inc.

Presscrete pile encasing is used for reconstruction, protection, strengthening and fireproofing of weakened piles to restore them to original strength and avoid cost of replacements. Concrete of great density is applied by air pressure in metal forms from which the water has been ejected by compressed air. The encasement is usually from 2 to 4 in. thick and reinforced with wire mesh or steel. The mix is silicified to resist chemical atack, and injected into the form bottoms and forced upward and compacted within the forms. The forms are removed after the concrete has hardened.

The treatment may be carried below the mud line, or applied only to such higher parts as have been attacked. No heavy driving equipment is needed, and work can progress with little interference. Form work is done from small boats, and air and con-

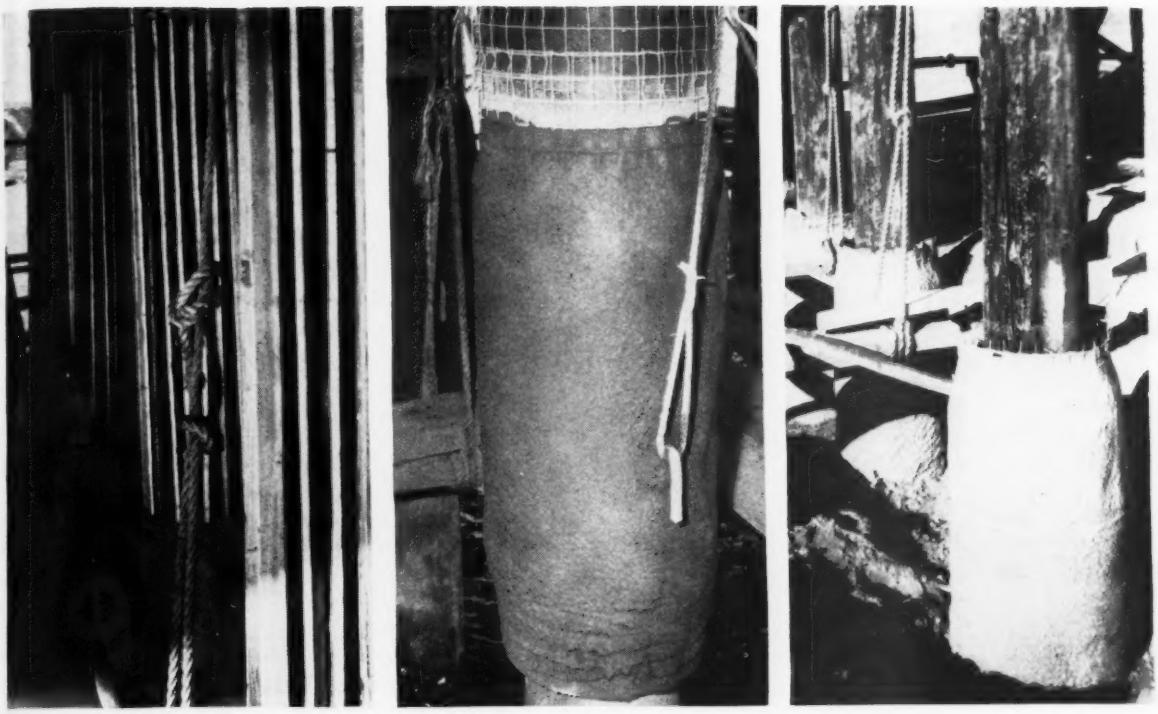


Fig. 3. The Johnson-Western method of pile encasement starts with cleaning the pile then tacking on 1x2 in. battens. Tar paper and mesh are wrapped around the battens and mortar shot on. Successive 5-ft. lifts are added and pushed down to the mud line, then the space formed by the battens is grouted.

crete are conveyed in hose or pipe from the shore or floating equipment. The method is controlled by The Presscrete Co., Inc.

The Johnson-Western pile encasement process is a method of repairing piles damaged by decay and marine borers, consisting of guniting circular concrete jackets in 5-ft. lifts above the water then lowering this jacket 5 ft. at a time until it is extended from high water line to 5 ft. below the mud line. The piles are first cleaned of marine growths, then 1 in. by 2 in. vertical spacer battens are nailed on the pile. The battens are tilted out slightly at the top.

Asphalt felt around the battens makes a form. Hooks are set in the bottom section, with the inner ends curved into guides to hold the shell equidistant from the pile. After the first section has set and is lowered, guniting on the next 5 ft. is continued, using the same battens with fresh felt. A water jet is used to sink the shell into the mud. The mud forms a bottom seal for grout tremied by hose into the annular space. Sway bracing is removed during the operation, then replaced. This method has been used by the California Division of Highways and is controlled by the Johnson Western Co.

Precast concrete casings

Precast casings of special design for pile protection are few but the precasting of concrete pipe is so common that a product for pile casing offers no difficulties. A suitable gasket to stopper the casing at the bottom and attention to jointing the sections are the only special details.

A patented form of precast casing first used in 1908 is the Koetitz. The patent covered a special design of sectional jacket with a minimum thickness of 2½ to 3 in. The piles were driven butt-end down, and the casings slipped over the top after driving. The space inside was pumped out and grouted. If the pile penetration can be predetermined, lugs can be bolted to the pile to support the bottom of the jacket. Care is needed in handling to avoid cracks which allow rusting of the reinforcement. The cost is relatively high, but the method has given excellent service.

On recent jobs, square jackets 4 in. thick have been used, with a rubber gasket driven with each pile to come at the bottom of the jacket and provide sufficient seal to permit grouting the bottom 5 ft., after which the remaining space was filled with rich concrete. For protection in the tidal range, the jackets were coated with asphalt mopped hot over a prime coat of 70 percent distillate and 30 percent roofing asphalt (*ENR* Oct. 22, 1942.)

Shot on casings

Recently gunite or shotcrete, shot directly on wood piles before or after driving, has been used frequently and very successfully. An old installation of gunite shot on before driving in 1922 was found in 1936 to present no evidence of cracking, spalling or detrimental effects from sea water, and was reported to appear good for an indefinite period (Fig. 4). The concrete was beveled into a dap in the wood at the bottom of the encasement to present a smooth surface. The coating was 2 in. thick, from 28 to 51 ft. long, extended from 2 ft. below the top to 5 ft. below the mud line, and was reinforced with 2x2-in. wire mesh.

During the recent war, inability to obtain treated piles of sufficient length resulted in the use of large numbers of untreated wood piles 100 to 125 ft.

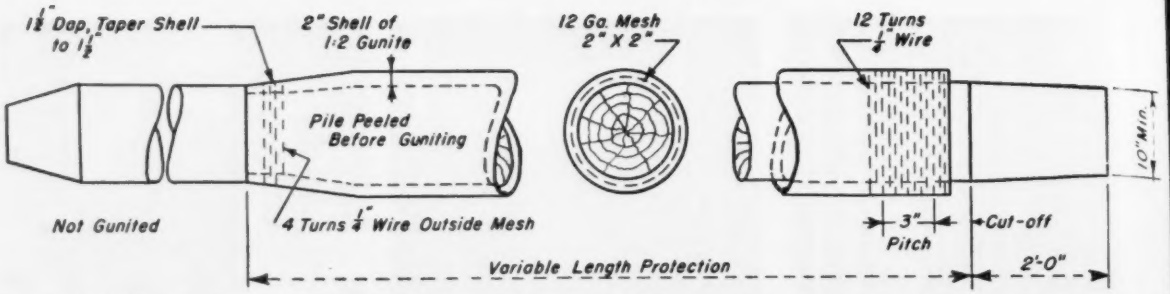


Fig. 4. Method of gunite casing, which appears good for an indefinite time after 13 years service. After pile is driven, top is cut off and protection added under cap.

long with shotcrete coatings in the upper 15 to 50 ft. designed to protect the upper portions and extend a few feet into the mud. (*ENR* Nov. 5, 1942, vol. p. 624, and March 25, 1943, vol. p. 425). The coatings were 1½ in. thick, reinforced with No. 12 or 14 gage, 2x2-in. wire mesh, with the top and bottom 6 in. having additional wrappings of six courses of No. 9 wire. It was found advisable to wet the piles before coating, to keep the shotcrete as dry as possible, and to lap the joints in the mesh 6 in. To prevent slipping of the coating it was found necessary to notch the piles 1 in. deep by axe cuts having a 4x4-in. area, spaced 18 in. apart in three or four rows.

Coating withstands hard driving

The piles withstood much harder driving than creosoted piles and could be driven much deeper without damage. They could also be driven deeper than precast concrete piles. As a test, over 5,000 blows on a pile driven to practical refusal, with a 15,000 ft. lb. hammer, failed to cause any damage other than cracking in the top 2 ft. of coating. The coated piles could be handled after curing three days when using standard cement.

This type of pile provided stiffer wharves than did uncoated piles, and had the added advantage of being fireproof. Costs compared very favorably with precast concrete, concrete-jacketed untreated wood, and treated wood piles.

Details of shotcrete jackets applied in 1945 are shown in Fig. 5. A 1:3 cement-sand mix 1½ in. thick was used, reinforced at the center with wire mesh held in place by metal clips driven into the pile. The clips had shoulders to place the steel ¾ in. from the pile, and recesses to hold the mesh. A hammer blow crimped the clip to secure the mesh. Protection was applied from 2 ft. above high water to 5 ft. below the mud line. The piles were wrapped with burlap and kept wet four days, then dampproofed as a curing aid. Adequate bond was found without surface-cleaning the treated wood, but 4 in. diameter holes 1 in. deep were drilled at 1 ft. alternate centers to provide mechanical bond as a safety measure. These jacketed piles were not damaged during handling or driving.

Experiments in Sweden to find a method of decreasing the solubility of Portland cement in sea water led in 1935 to the use of a cement gun to apply to wood piles, before driving, a coating of concrete with an admixture of arsenious oxide (As_2O_3). The resulting solubility was claimed to be 1/40 of that of concrete without the admixture. The piles were water-soaked before coating, unless coated just after cutting. Initial set took place in 1 to 5 min.

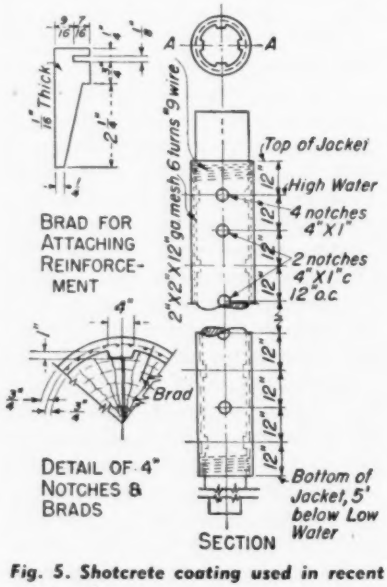


Fig. 5. Shotcrete coating used in recent construction.

Excellent results were obtained in driving piles 39 ft. long, coated for 15.4 ft. Reinforcing mesh was used, having 3/32 in. wires spaced ½ in. apart, fastened with 3 in. galvanized nails 4 to 5 in. apart and projecting 1¼ in. A second coating could be nailed and applied, if the nails were driven within an hour after the first one. The piles were driven without damage by a 1,765-lb. drop hammer falling up to 26 ft. In summertime, the piles could be driven two hours after coating.

Pressure-jacketed concrete encasements can be applied to wood piles before driving, by use of pneumatic pressures of from 5,000 to 8,000 psf. in air-tight metal forms equipped with pressure heads for air and concrete connections. Reinforcing may be used. The concrete can be silicified to provide resistance to chemical action. This method is controlled by The Presscrete Co., Inc.

In summary

A review of armoring and jacketing methods of pile protection shows metal armoring gradually fading out of the picture. Concrete jacketing is in turn apparently shifting from under water construction to applying the protection before the pile is driven. With better understanding of borer aggressiveness, modern processes of increasing concrete density and resistance to sea water, and jacketing open to inspection before driving, concrete offers increased service for pile protection. The very best modern practice may prove to be such jacketing, applied to creosoted piles.

Use of creosote and other types of chemical treatment will be reviewed in the concluding article, to be published in a subsequent issue.

Fig. 1. The older power plants at Shawinigan Falls take water from a pool formed by two dams across the river channels above the falls (right center). The intake for the new plant is being built to the right of the gatehouse of Power House No. 2 (center), and the plant itself is below it along the edge of the river below the bridge over the falls.

More Power at Shawinigan Falls

***Contents in Brief**—Construction of a new hydro-electric power station at Shawinigan Falls, Que., is under way to expand the output of the plants of the Shawinigan Water & Power Co. at that point. It will contain three 65,000 hp units, bringing the total capacity installed of company's plants at that point to over 500,000 hp.*

SHAWINIGAN FALLS on the St. Maurice River 100 miles northeast of Montreal has been a foremost power producing center for nearly half a century. Nature made the harnessing of power at the falls easy by providing a topographic formation that brought the river close to the edge of the valley below the falls in a long bend before reaching the point where it cascades nearly 150 ft. down a rocky channel to the lower level. This made it easy to tap the river above the falls and develop the full head without large dams or costly diversion works.

Before the turn of the century, plans were underway to develop electric power at this point and the first of such installations was completed by the Shawinigan Water & Power Company in 1901. It consisted of two units of 5,000 h.p. capacity each, developing 30-cycle power. Shortly after there was put into service another installation which consisted of hydraulic turbines driving the machinery in a pulp mill.

The cheap power attracted metallurgical plants needing large quantities of power. One of the early companies to build such a plant was the Pittsburgh Reduction Co., later the Aluminum Company of Canada, which leased water rights from the Shawinigan Company and built its own power plant. Another of the early companies was the Canada Carbide Co., now a part of Shawinigan Chemicals Ltd.

As the years went on, more and larger units were added in what is known now as Plant No. 1 of the Shawinigan Company, developing finally 58,500 hp. In 1910, construction of Plant No. 2 of that company was started. It generates power at 60 cycles and ultimately was expanded to include eight units ranging from 18,500 to 43,000 hp., bringing the total capacity of Plant No. 2 to 221,500 hp. A walk through these two plants is like taking a short course in the development of hydroelectric power equipment, so wide is the variety of prime movers installed there.

Regulation of the stream flow made necessary both by the installation of additional units in Plant No. 1 and by the proposed construction of Plant No. 2, was accomplished by the con-

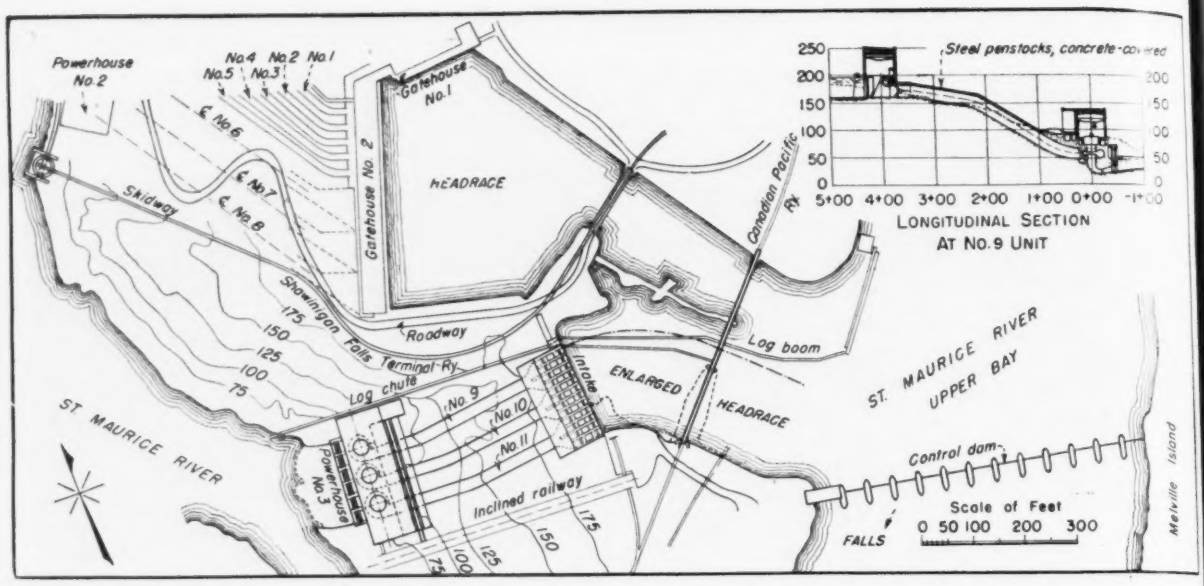


Fig. 2. The relation of the new plant (No. 3) to the existing plants is indicated by this plan. Enlargement of the headrace serving plants No. 1 and No. 2 is included in the present work.

struction between the years 1907 and 1911 of three large storage reservoirs on the Manouan River, a tributary of the St. Maurice River. These three reservoirs provided a capacity for the storage of seventeen billion cubic feet.

The provincial government subsequently undertook additional regulation of the flow and in 1917 completed the Gouin Reservoir at the headwaters of the St. Maurice River, a reservoir having the enormous capacity of two hundred and eighty billion cubic feet, making possible a large increase in the firm power that could be produced on the river.

Since that time, additional storage reservoirs of smaller capacity have been built in some of the tributary streams, and the Shawinigan Company has built and acquired additional power plants on the river: the La Gabelle Plant immediately below Shawinigan Falls and other plants further upstream at Grand'Mere, Rapide Blanc and La Tuque, the latter in association with the Brown Corporation.

The pondage above the Grand'-Mere plant provides regulation for peak load purposes of about 28,000 cfs. which is available in the three lower St. Maurice plants at Grand'-Mere, Shawinigan Falls and La Gabelle. The discharge capacity of the units at Shawinigan Falls has for some time been below that at the other two developments and when a change in the operations of the Aluminum Co. made additional water available at Shawinigan Falls it was decided to increase the installation there to bring the discharge capacity into line with that of the other two plants.

New power plant

The present power stations at Shawinigan Falls are built on the slopes of a point of land which the river passes on its way to the falls, as shown in Fig. 1. They are served by a forebay formed along the top of this point of land. The water level in this forebay and in the river above the falls is controlled by crest gates on low dams across the two channels of the river at the top of the falls. The new plant also will be served by this forebay, but it will have to be considerably enlarged, and the enlargement includes cutting back an embankment of the Canadian Pacific Railway and adding a second span to the railway bridge over the forebay.

Much of the excavation for this forebay is in rock. Considerable rock excavation also was required for the intake structure at the lower end of the forebay, which will contain nine gates 14 ft. wide by 22 ft. high, each set of three gates controlling the flow through rectangular sluiceways that are combined into one 22-ft. diameter steel penstock at the downstream end of the intake structure.

Because of the large quantity of pulpwood that is handled in the river, all the trash racks in this intake structure are to be equipped with mechanical rakes. Provision also will be made for heating the rack bars to minimize trouble with frazil ice.

A short spur from the railway line crossing the forebay will serve an inclined railway by which standard-gage railway cars can be lowered to tracks at the power house.

At the northerly side of the intake structure is a log gate discharging into a steel trough extending down the slope to a point below the power house. This chute replaces an older one in about the same location. As it is the main route by which pulpwood passes the power plant, it had to be kept in service all during construction. Until the forebay extension is completed, it is served by a wooden flume carried over the cofferdam and forebay area.

The three 22-ft. diameter penstocks are set in shallow trenches cut in the rock slope down to the power house. They are to be encased in concrete and covered over with backfill.

The power plant is set in a deep rock cut at the side of the river channel immediately below the falls. This cut was made behind a sheeted crib cofferdam of sufficient height to keep out fall or winter floods, but

not high enough to protect against a spring flood as plans called for completion of the lower part of the structure before high water comes this spring. The cofferdam now stands on a rock ridge between the tailrace and the river which will have to be taken out by submarine blasting after the cofferdam has been removed.

The power plant is to contain three 65,000-hp. units consisting of vertical Francis-type hydraulic turbines operating under a head of 145 ft. and coupled to water-cooled, totally-enclosed, three-phase 60-cycle generators.

The substructure of the power house is of concrete (Fig. 3) and the super-structure has a steel frame and brick walls, the architectural treatment being along modern lines.

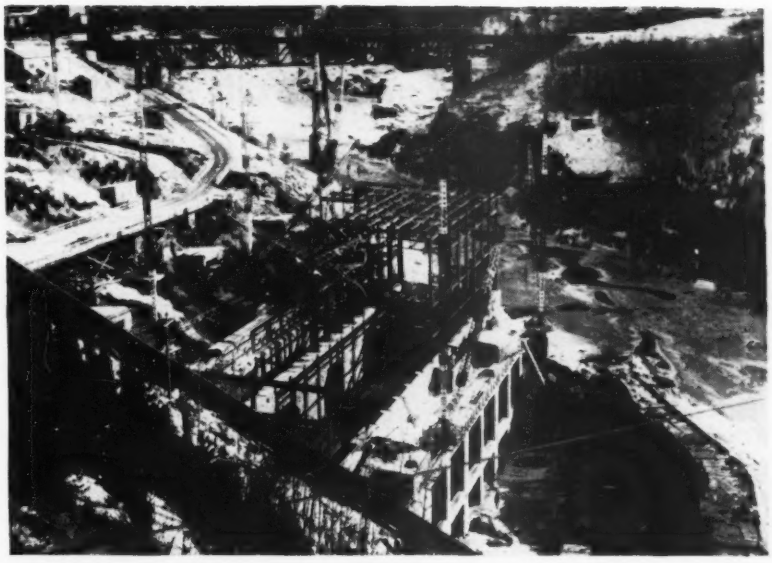


Fig. 3. Setting steel for the powerhouse. In the right foreground, the rock barrier below the remains of the cofferdam along the frozen river is being mined so that it can be blown out to clear the tailrace.

Much rock excavation

In all, about 200,000 cu. yd. of rock had to be excavated for this new plant. As it is rock of good quality, part of it is being used for concrete aggregate. In contrast to the large amount of rock excavation, only 60,000 cu. yd. of concrete are required. This small amount of concrete resulted in a decision not to install a jaw crusher in the rock-processing plant, using only gyratory crushers. As a result, much more hand breaking of rock was required than would have been necessary in the preparation of the crushed stone.

Sand for concrete comes from a pit about six miles away. It is not as well graded as is desirable, being high in fines, thus requiring somewhat more cement. Cement is delivered in bulk by rail right to the concrete plant.

Concrete is distributed in 2-yd. end-dumping truck bodies built especially for the job. They discharge into hoppers near the point of use, which in turn fill 2-yd. buckets handled by guy derricks that deliver concrete to the forms.

The guy derricks, painted alternately red and white, are a conspicuous feature of the job. The first few of the seven now in use were painted green, but their swinging booms were hard to see, hence the present color scheme.

Plywood, ⅝ in. thick, is specified for the forms for all concrete that will be exposed in the finished structure; dressed 1-in. sheeting is used for the forms for all other concrete. The plywood forms were built in panels for re-use several times, but experience has shown that they can only be used about twice as they do not stand handling by derricks well. If they could be moved from one point of use to another by hand, a longer life might be obtained.

Construction program

Construction was begun late in 1946 in the expectation that most of the substructure concrete could be placed during the summer months of 1947. Early work included the difficult task of building a cofferdam in the turbulent forebay to shut off the side that was to be widened. Timber cribs for this cofferdam were partly built on dry land, launched and sunk in place by filling them with rock. The outer faces then were sheeted, the sheeting being driven into the bottom or being packed with bags of cement and sand to make the lower edge tight.

Fig. 4. Concrete is transported from the central mixing plant in specially built end-dumping trucks of 2-yd. capacity. These trucks dump to hoppers that supply the buckets by which derricks distribute concrete to the job.

Another early construction operation was building the pier in the forebay area that is to carry the railway bridge. After new abutments had been completed the existing span was shifted north 35 ft. and a new second span was installed.

Most of the substructure concrete had been placed by the end of 1947. It is expected that the plant will go into operation late in 1948. Total cost will be about $12,500,000.

Plant No. 3 was designed by The Shawinigan Engineering Co. Ltd. of Montreal, a subsidiary of The Shawinigan Water & Power Company and the same organization is doing the construction work. J. A. McCrory is president of The Shawinigan Engineering Co. Ltd. and R. E. Heartz is vice-president and chief engineer. The company is represented on the job by E. Brock, general superintendent and R. A. Parsons, resident engineer.

Tainter Gates of Simplified Design

D. A. Buzzell,

Civil Engineer Corps of Engineers, U. S. Army

Contents in Brief—For use on Army flood-control dams a simplified tainter gate design has been prepared that reduces the weight of the moving parts of a 64 x 30-ft. gate by nearly 30 percent. Savings for smaller gates are even higher. The design calls for a skin plate welded to the vertical beams with this face structure supported by two or three frames each consisting of a horizontal beam and two inclined struts extending to the trunnions of the gates.

A TAINTER crest gate design embodying no new principles but which places great emphasis on the principles of simplicity and economy has recently been developed by the Corps of Engineers. With the improved design the weight of the moving parts of a 40 x 26-ft. gate has been reduced to 58,200 lb., while that for a 64 x 30-ft. gate is only 146,000 lb., compared to 230,000 lb., for older gates of the same size.

The inventor of the tainter gate, Jeremiah Tainter, between 1875 and 1881 took out several patents covering his basic design. The drawings accompanying the applications for these patents are based on the use of wood framing, but they show that the inventor was aware of all the principles on which to base a simple, economical design.

Because most radial-gate installations in the past consisted of only one or two gates, exacting economy in designing the gates was generally a secondary consideration. The general plan and details of framing were largely left to the designer's fancy. The result has been the development of a variety of ideas mostly following truss or rigid-frame lines. The weight for large gates of these types has ranged from 86 to 119 lb. per sq. ft., of opening, and carry-over and secondary stresses caused by the type of framing used have been a bothersome problem.

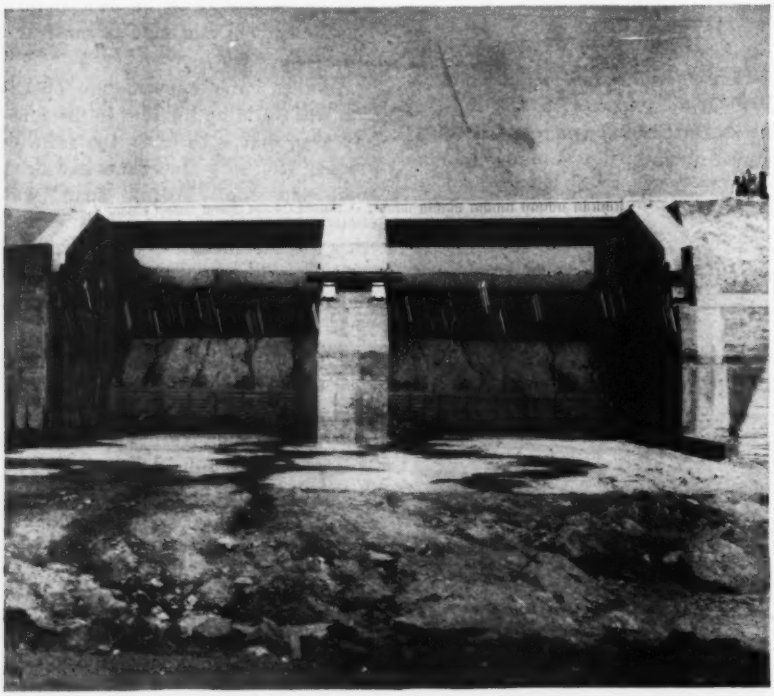


Fig. 1. A gate of the simplified design for an opening 40 ft. wide and 29 ft. high. Most connections are welded.

Big weight saving secured

Recent Corps of Engineers designs show that the same openings can be closed by gates of simple and conservative design free of ambiguities and weighing only from 56 to 76 lb. per sq. ft. An economy of 40 lb. per sq. ft. is of little importance for one or two gates. However, in the case of a large dam, requiring, for instance, twenty 40 x 30-ft. gates with a total area of 24,000 sq. ft., the 960,000-lb. saving at an average price in place of 30 cents per lb. is an important item. Moreover, the design is streamlined to reduce the number of members and their surface areas, thus promoting economy in maintenance.

The Corps of Engineers design calls for a skin plate supported by a row of vertical beams continuously or intermittently welded to the skin plate (Fig. 1). Split I-beams or T's are generally used for these vertical beams. The face structure in turn is supported by either two or three gate frames so spaced as to minimize bending moments in the face structure.

Each gate frame consists of a horizontal beam reacting on two inclined struts that carry the reactions to the trunnions. The struts are inclined sufficiently in the horizontal plane that the distance from the point where a strut intersects the horizontal beam to the near end of this member is two-tenths the beam's span. The struts are inclined in this manner to balance bending moments in the

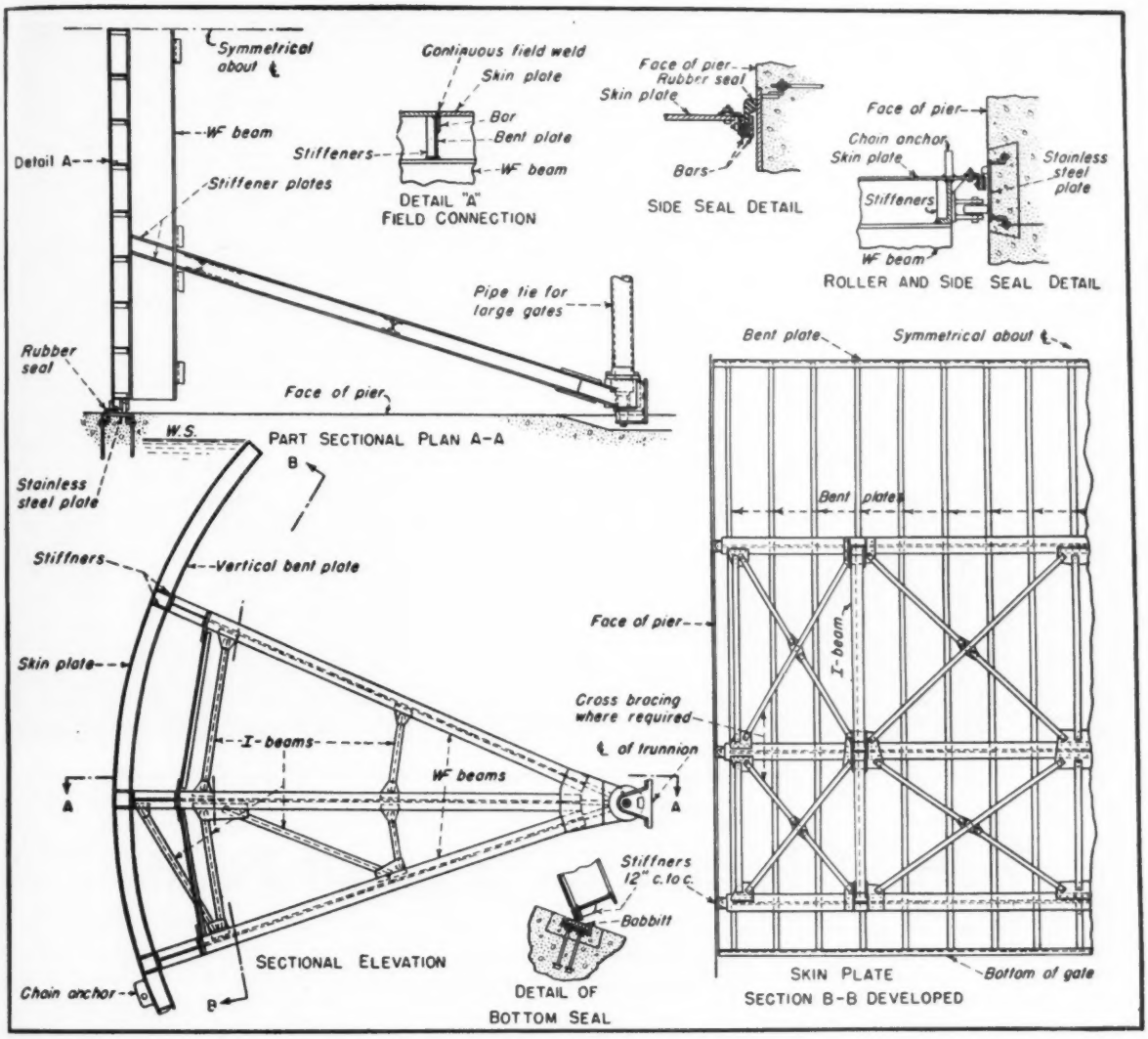


Fig. 2. Details of the tainter gate designed to reduce the weight of moving parts and eliminate costly fabricating operations.

horizontal beams and to avoid carry-over moments in the structure.

Rolled sections are used for the beams and struts wherever possible, but for the larger gates it is generally necessary to use three heavy plates continuously welded into a heavy I-section for each horizontal girder. A steel tie can be run from trunnion to trunnion to absorb the lateral thrust of the inclined struts or the piers can be reinforced to take this load component. When the tie is used, the gate frame forms a closed system and no lateral thrust can be transmitted to the piers.

The trunnions are simple steel castings with short pins supported at each end, while the trunnion girders are welded boxes, attached to a pair of horizontal I-beam anchors. The anchors are extended from the trunnions to a point a few feet upstream from the face of the gate and there attached to heavy transverse anchor members. They are carefully unbonded throughout their entire length so that the entire gate reaction will fall on the anchors and no tension will be created in the pier concrete.

Table I—Weights of gates of various sizes based on new design.

Size in ft.	*Total wt. in pounds*	*Weight lb./sq. ft.*
40 x 26	58,200	56
40 x 28	73,500	66
50 x 37	136,000	74
64 x 30	146,000	76

Table II—Weights of gates of various sizes based on older trussed designs.

Size in ft.	*Total wt. in pounds*	*Weight lb./sq. ft.*
40 x 25	105,000	105
40 x 32	140,000	109
64 x 30	230,000	119

Note: The weights indicated are for the moving parts only. The fixed parts will weigh about half as much as the moving parts.

The weights of a few typical size gates of the new design when using a maximum steel stress of 18,000 psi., including secondary stresses are given in Table 1. Weights of comparable gates of the older design, including some built as late as 1942, are given in Table 2.

Gates of the new design are scheduled to be used on at least three large dams now under construction. These structures are: Allatoona Dam on the Etowah River near Cartersville, Ga.; and Wolf Creek and Center Hill dams in the Cumberland River basin.

Fig 1. Manhattan's asphalt plant is housed in this unusual structure because of its conspicuous location.

Electric Heating for Asphalt Plants

Ladis H. Csanyi
Consulting Engineer, New York

Editor's Note—The Municipal Asphalt Plant of the Borough of Manhattan, New York, was the first in the country to use electric heating extensively. Experience in operating the plant has indicated that such heating could be used to advantage elsewhere, especially where power rates are low. Mr. Csanyi, author of this article, was engineer of research during the investigations that led up to adoption of electric heating, participated in the design and construction and then was in charge of operation.

HEATING THE PIPES, valves, pumps and tanks used to distribute asphaltic cement to mixers in a plant preparing materials for use in asphalt pavements has always been a major problem in such plants. Common practice in the past has been to use high-pressure steam, but such a method of heating requires that steam pressure be maintained at all times, and the narrow limits in temperature that are essential to proper operation are difficult to maintain. Also, leaks are difficult to avoid, and leaks from heating coils in tanks frequently have caused the loss of much asphalt in the past.

When the Borough of Manhattan found it necessary to rebuild its asphalt plant, an extensive research program was inaugurated to develop a more efficient plant and one that would be reasonably free of many of the disadvantages of the old one. Out of this research came the decision to use electric heating for facilities for handling and storing asphalt cement. One factor that influenced this decision was the fact that the plant is located in a high-class residential area where elimination of steam boilers was desirable.

The facilities in the new plant equipped with electric heating devices include: all asphaltic-cement pipe lines together with fittings, valves and other appurtenances; asphalt-cement pumps, meters, strainers, tanks, spray bars; and the body of the mixers. Fuel oil is used for heat in the sand and stone dryers.

Power furnished to the plant under contract is 208 volt, three phase, 60 cycle, alternating current for power and 120/208 volt, three phase, 60 cycle, alternating current for lighting. It enters through a transformer house where it is stepped down to plant

requirements. Service breakers are located in this building. Power for heating is sent to the control room where the system is divided into two sections, one distributing it to several local push-button control panels for heating all pipelines, pumps, surge tanks, meters, strainers, spray bars and mixers, and the other for heating the tanks, each of which has a separate control panel containing all the necessary electrical protective devices and electrical devices for manual, semi-automatic, automatic operational controls, temperature recorders, heater operation indicators, and time switches.

The new plant manufactures hot plant-mix types of paving materials such as sheet asphalt and asphaltic concretes which cannot be stored for any great length of time. It has two complete units, each with a normal capacity of 350 tons per day; but due to the fact that the plant must be able to turn out about half its capacity between 7:30 a.m. and 9:30 a.m., the mixers have a peak capacity of 120 tons per hour. For the same reason, the plant is equipped with two 100-ton capacity hot-storage bins over the mixers, which are unique in that they are completely insulated.

Handling asphalt cement

Asphalt cement is brought to the plant in barges of 60,000 to 80,000 gal. capacity which tie up to a wharf across the East River Drive from the plant, from which point steam driven pumps on the barge tugs are used to pump the asphalt cement to the plant storage tanks.

Application of electric heat begins in these lines. In general, various types of "Calrod" heating elements, manufactured by the General Electric Co., are used for all heating.

All asphalt-cement pipe lines are constructed of 4-in. continuous welded heavy steel pipe. Attached by steel straps on the underside of these pipes are the heating units, each of which is about 18 ft. in length and has an effective heating length of about 15 ft. Electric junction boxes and feeder conduits are suspended from the pipe about 6-in. below the underside of the pipe. The pipes themselves are supported on rollers in ceiling hangers or wall brackets. Around the pipe and heaters, a 13-gage continuous sheet-metal covering is strapped to provide an air space around the pipe and to serve as a base for the final 2-in. asbestos insulation of the pipe.

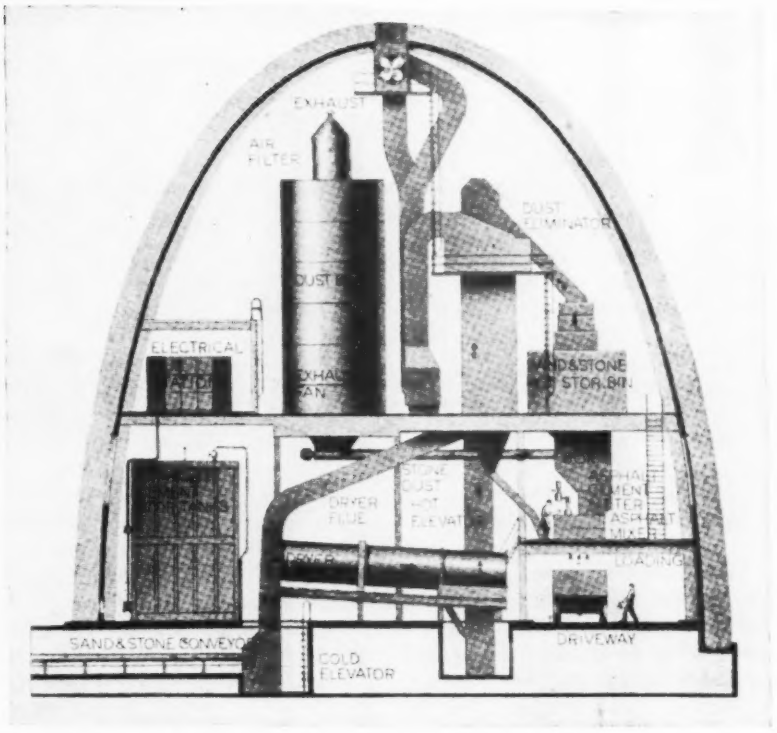


Fig. 2. Schematic cross-section through the asphalt plant. All machinery is supported on a steel frame independent of the exterior shell.

Since the electrical heating units can be bent into intricate shapes having bends of a minimum radius of 2 in., appropriate lengths of the units may be entwined around valve cocks, bends and other fittings to give a completely heated pipe system. Coverings similar to straight piping is provided for the fittings. Electrical thermostats, manually adjusted for temperature range, are installed in the line at strategic points to control the temperature of the line.

At the operating control panel the heating of all pipe lines from dock to tanks to mixers, and pumps, is controlled by manually operated switches. The operation of the pumps is also controlled from this panel. All switches are fitted with indicator lights designating a closed circuit. Thus, at this panel, an operator may tell at a glance all pipes that are being heated. This is extremely important, as will be seen later.

The transfer of asphaltic cement from barges to tanks is simple. Taking into consideration the time of arrival of the barge, and allowing one hour, the time required for the necessary measurements of quantity and temperature, and for discharging connections, the approximate time when pumping will begin, can be estimated. Bearing in mind that three to four hours are required for heating the lines to assure complete liquification and elimination of slugs left from previous pumping operations, the time when heat is to be applied to the lines, in order to be ready for the barge can be estimated. Time tabs are inserted over the heater switches denoting the time each switch is to be operated, so that the man on duty may place each switch into service at the proper time.

With lines heated, pumping may begin as soon as barge discharge connections are made and tank distribution valves are set. Asphalt cement is usually delivered in the barges at a temperature between 280 and 330 deg. F. The pumping rate in this range is about 14,000 to 15,000 gal. per hour for a 60-70 penetration asphalt cement. As the temperature falls below 270 deg., the pumping rate falls rapidly. Asphalt cement has

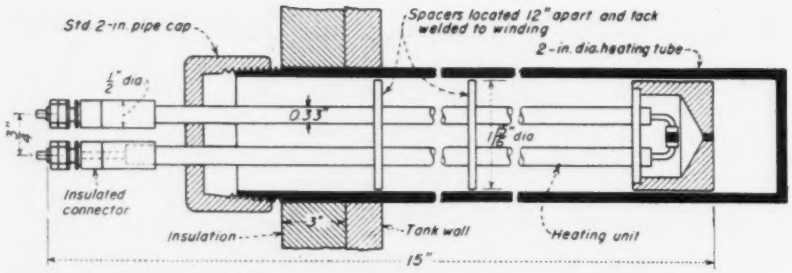


Fig. 3. Details of one of the electric heaters inserted in the tanks. The heating element can be withdrawn easily for repair or replacement.

been pumped at as low as 250 deg. at a rate of 4,000 to 5,000 gph. but the strain on the pump and piping was extremely severe.

It was found that as soon as asphaltic cement begins to flow through a pipe line, external heating of the line may be discontinued. The loss in temperature of asphalt in passing continuously through a preheated and insulated pipe line is slight. In accord with these findings, the heating of pipe lines is discontinued as soon as asphalt has flowed through the lines for a few moments during intake operations. With thermostats properly set, this would normally occur automatically.

Heated storage tanks

Asphalt cement is stored in a composite storage tank of 125,000 gal. capacity, consisting of five sections, all rectangular in shape, with two sections in a lower and three sections in the upper tier. The two sections, designated tanks No. 1 and No. 2 each have a capacity of 30,000 gal. are used for reserve storage, wherein the temperature of the asphalt cement is maintained at 270 deg. F. The upper sections designated as tanks No. 3, No. 4, and No. 5, have a capacity of 25,000, 20,000, and 20,000 gal. respectively. Tank No. 3 is used for reserve storage, while tanks No. 4 and No. 5 are service tanks wherein the temperature of the asphalt cement is raised to and maintained at 320 deg. The entire composite tank is fully insulated by a 3-in. asbestos blanket and one half inch plastic insulating material covered by an eight-ounce canvas jacket.

In the tanks, the method of application of the elements differs from that used on piping. Here no direct contact between element and pipe is made, and heat is transferred from the element through an enclosed body of air to a tube immersed in the tank. This differs also from other methods wherein the element itself is immersed in the heated medium.

The tanks in this instance are provided with 2-in. wrought iron heating tubes extending through the rear wall to the front wall, and uniformly spaced across the tank about a foot or two above the bottom. The tubes are firmly supported from the walls and bottom of the tanks. Tanks No. 1, No. 2, No. 3, No. 4, and No. 5 are provided with 15, 15, 12, 33, and 33 tubes, respectively.

The open ends of the tubes outside the tank are enclosed in a large rectangular electrical junction box within which the electrical connections of the heating elements are made. The heating elements inserted in the tubes are of special design (Fig. 3), a complete element consisting of two straight elements each about 15 ft. in length, lying side by side about three quarters of an inch apart, connected in series by brazing the two inner ends. The inner end is fitted with an end plate and cap of such size and diameter that it acts as a guide and centering device within the tube. Similar guide and centering disks are welded to the element on 12-in. centers along its length. At the junction box end, a standard 2-in. pipe cap is welded around the element. Thus a single complete element is fabricated in a manner to permit it to slide easily into the tube as a unit, and it may be firmly attached therein by simply screwing up the pipe cap on the open end.

A heating element made up in this manner will have a wattage rating of about 3.5 kw. With all tubes in the tanks equipped with such heating elements, tanks No. 1, No. 2, No. 3, No. 4, and No. 5 acquire a wattage rating of about 50 kw., 50 kw., 40 kw., 110 kw., and 110 kw., respectively.

The surge tanks are similarly fitted but with shorter elements in three tubes yielding a wattage rating of about 8 and 5-kw. per tank.

The design of the heating capacity of these tanks was predicated upon two basic requirements. First that tanks No. 1, No. 2 and No. 3, the storage tanks, have sufficient capacity to raise the temperature of a tank full of asphalt cement from 30 to 260 deg. F. in 24 hours and thereafter maintain this temperature. Second, that tanks No. 4, and No. 5, the service tanks, have sufficient capacity to raise the temperature of the tank full of asphalt cement from 250 to 325 deg. in 15 hours and then maintain this temperature. These requirements when correlated with the requirements of the volumetric capacity of the tank, which was predicated upon sufficient storage capacity for the manufacturing units operating at full capacity for the entire day, establish a definite operating procedure. This entire relationship stems from the manner in which electricity is sold for industrial consumption. This is discussed later.

Heating pumps and meters

Equipment such as asphalt pumps, meters and strainers that normally are provided with heating jackets for steam require a special treatment. In these cases, circulation of a heat-transfer oil, heated by immersion "Calrods," through the jackets provides the heating medium. The system consists of a reservoir tank of adequate size for the system, immersion heaters of proper intensity and a small hot-oil circulating pump of adequate capacity and piping. The entire system including the jackets is completely insulated. This method, even when heat transfer oil at 550 deg. is maintained in circulation, is much slower than direct application of heating elements. Further, satisfactory operation depends upon a free and adequate flow of oil through the system. Consequently, wherever heating elements may be applied directly to the equipment as boosters, increased efficiency will be attained.

The original devices installed to

heat the mixer spray bar and mixer body were strip heaters. After six months of operation, loss of heating efficiency was noted, and electrical tests showed many open circuits, full grounds and flickering grounds. Inspection disclosed that wherever good contact was not maintained between the strip heater and the body, the heater was burned out, and generally even though special heat resistant insulation wiring was used, the insulation had failed causing the ground and flickering grounds. Therefore, the heating installation was removed and replaced by "Calrod" heating elements with outside connections.

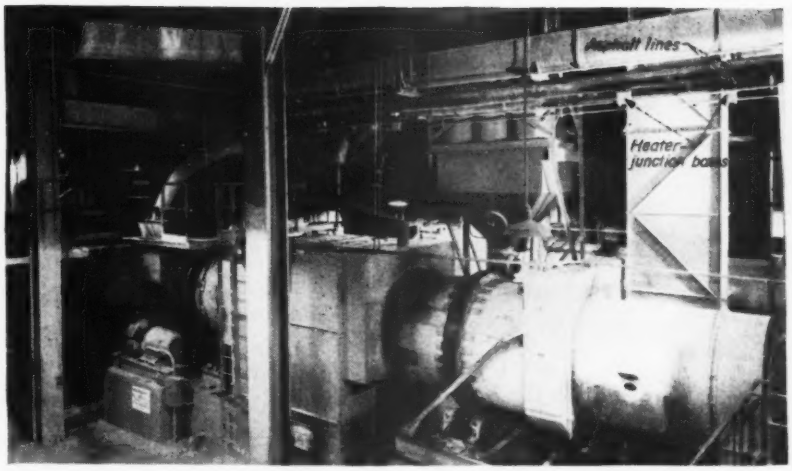


Fig. 4. Above the dryer are the jacketed feed and return lines with their electric heaters that deliver asphaltic cement from the tanks to the mixer. Immediately below them are the junction boxes and conduits serving the electric heaters.

Consumption of electricity

Electricity sold for industrial consumption is usually charged under two categories — demand and consumption rates. The demand, measured in kilowatts, is established by the maximum peak load attained for a period in excess of fifteen minutes during the month. The consumption, in kilowatt hours, is the measure of the quantity of electricity used during the month. The demand rate is usually fixed per kilowatt, while the consumption is charged on a sliding scale relative to the quantity of current used. At the plant, the demand rate is $1.75 per kw. and the consumption rate is three-quarters of a cent per kilowatt-hour.

Under these conditions it becomes apparent that the electrical costs are dependent upon a correlation of efficient operation and minimum demand. With this relationship in mind and with the knowledge that the demand of electrical heating is less than that required for operating the plant, the design of the electrical heating was so developed that all electrical heating would be done during the time the machinery was shut down. By this arrangement, the superimposition of heating demand upon operating demand was eliminated and peak demand retained at that required for machinery operation.

To keep costs down, operating procedures were developed under which the transfer of asphaltic cement from storage tank to service tank is begun immediately upon the shutdown of enough machinery to cover this demand. After the transfer is completed, and other machinery shut down, tank heating is begun. Then early in the morning, prior to the starting of machinery with a sufficient time allowance to assure completion of the operation, the pipe line, pump, surge tank, meter and mixer heating is undertaken. In this manner, all heating may be done at the off-peak-load periods.

After twelve months of operation, during which a careful study was conducted of the operational characteristics of the heating system, the following procedure was established. Immediately upon discontinuing of mixing, the surge tanks and feed lines are cleared by blowing back with compressed air. Then service tanks are refilled from storage tanks. Immediately after the dryers and exhaust fans are shut down, tank heating may be started. With the knowledge of the quantity of asphaltic cement transferred to the service tanks and its temperature, a sufficient number of heating elements in the tanks are placed in semi-automatic operation to assure the raising of the temperature to the desired range within eight hours and to maintain the desired temperature thereafter.

The proper time intervals required to heat the pipe lines, surge tanks, meter and mixer were determined in the study. Since these units are operated from control panels and switches nearby, each push button station and switch is provided with a time tab indicating the time each control shall be actuated. The time on these tabs is determined by subtracting the time interval required by each unit from the starting time of the plant. The night man who patrols the plant operates these controls at the proper time, thus assuring all units ready for operation when the plant force arrives.

Before any machinery is started, the asphaltic cement is circulated through the feed lines, the surge tanks filled, and circulation by-passed to return lines. Heating of these units is then discontinued and next, tank heating is discontinued. Then, just before starting the mixer, the mixer feed line, meter and mixer heating units are shut off. In this manner, a smooth sequence is carried out that precludes the possibility of the heat load being superimposed on the operating load.

Operating costs in this plant will be considered in a subsequent article.

The plant was built by the Borough of Manhattan under the direction of Walter D. Binger, commissioner of borough works, Lester C. Hammond, chief engineer, and his successor, Dean G. Edwards. Buildings were erected by the Stock Construction Co., and machinery and equipment were installed by F. D. Commer & Sons. The plant was designed and construction was supervised by civil service employees of the president of the Borough of Manhattan.

A paper describing the design and construction of the entire plant is to be published soon in *Proceedings* of the American Society of Civil Engineers.

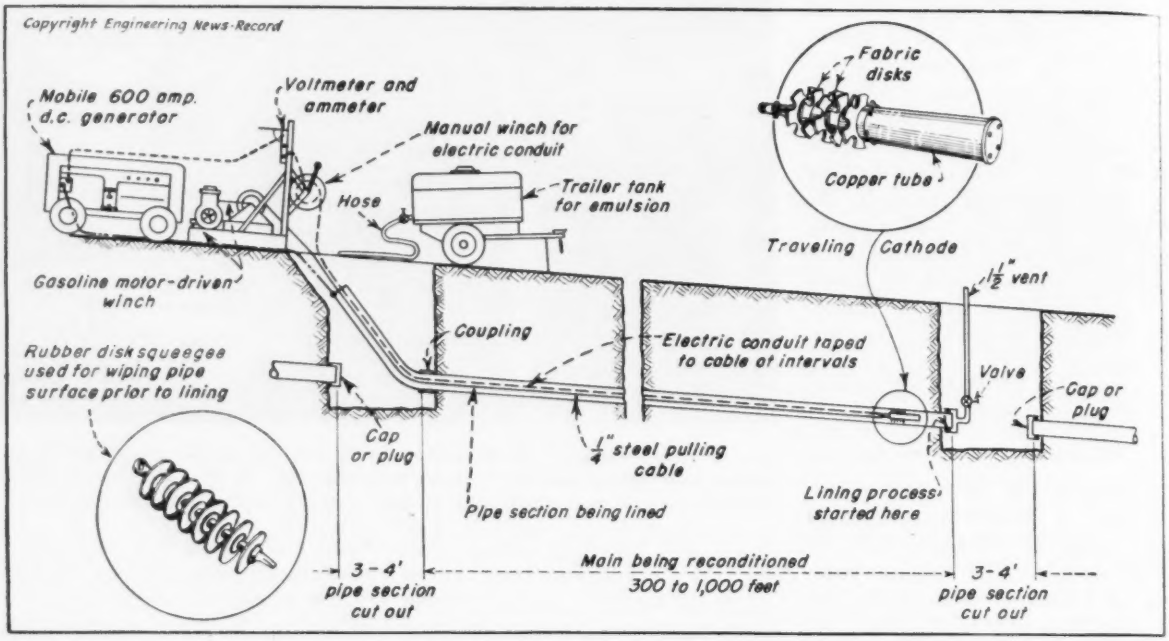

Copyright Engineering News-Record
Mobile 600 amp. d.c. generator
Voltmeter and ammeter
Manual winch for electric conduit
Trailer tank for emulsion
Hose
Fabric disks
Copper tube
Traveling Cathode
Gasoline motor-driven winch
Coupling
Electric conduit taped to cable at intervals
½" vent
Valve
Cap or plug
Rubber disk squeegee used for wiping pipe surface prior to lining
Cap or plug
¼" steel pulling cable
Pipe section being lined
Lining process started here
3 - 4' pipe section cut out
Main being reconditioned 300 to 1,000 feet
3 - 4' pipe section cut out

Fig. 1. After mechanical cleaning, sections of Highlands, N. J. mains were lined with bitumen electrolytically deposited from an emulsion by means of a slowly moving cathode. Direct current was supplied to the moving cathode through a rubber-coated conduit while the cathode was pulled along by a power winch.

Water Mains Lined-In-Place With Electrically Deposited Bitumen

***Contents in Brief**—A process for rehabilitating water mains in place, after mechanically cleaning, by electrolytic deposition of bitumen has recently been brought to the United States from England. By means of this process, a thin asphalt coating is applied to internal pipe surfaces. Cleaning and lining projects have been undertaken at Long Beach, N. Y., Highlands, N. J., and Charlotte, N. C. It is reported that the treatment provides indefinite protection; restores carrying capacity, and costs considerably less than an equivalent installation of new pipe.*

RECONDITIONING of water mains in place by application of electrically deposited bitumen is being introduced in this country, based on practice in England where it has been in use for more than ten years. Several cleaning and lining projects have been undertaken, one of the most recent being at Highlands, N. J., where more than 11,000 ft. of 4- and 6-in. pipe were rehabilitated. The mains at Highlands were cleaned and coated to restore carrying capacity as well as minimize further tuberculation caused by aggressive water.

The lining process is based on the fact that asphalt, when suitably emulsified, can be electrolyzed and deposited on the anode of an electrochemical system. Taking advantage of this phenomenon, a procedure has been developed whereby water pipes may be lined in place with bitumen. The pipe itself serves as the anode, a traveling copper tube centered inside the pipe acts as a cathode, and the bituminous emulsion is the electrolyte.

Known as the Eric Process, this system of lining mains is said to have a successful record of performance in England for more than 10 years where as much as 2,500,000 lin. ft. of pipe in 30 distribution systems are reported to have been treated. Introduced in the United States in April, 1947 by the Pittsburgh Pipe Cleaner Co., under arrangement with the Eric Engineering Co. of England, the method is called the Pittsburgh-Eric Process.

As employed at Highlands, the reconditioning process consists of five steps: (1) location of the pipes; (2) isolation of the section to be lined (a 300-1,000-ft. length), excavation of extremities and extraction of short lengths of pipe at each end; (3) mechanical cleaning of selected sections; (4) squeegeeing internal pipe surfaces prior to coating; and (5) lining of section with electrically deposited bitumen.

Mains located with pipe finder

First, the mains to be treated were marked out on the pavement using a pipe finder because the buried pipes were not referenced on distribution system maps. To minimize excavation and pavement damage and to attain

faster progress, straight runs of a convenient length were then selected for cleaning and lining. Sharp curves, bends and irregular alignments were handled in short lengths.

Excavations, about four feet square, at the ends of selected sections were dug to a depth of about one foot below the pipe. Isolating valves and house connections were shut off and short lengths of pipe cut out in each pit to permit insertion of cleaning tools. To actuate these tools, a ½-in. cable was pulled into the pipe by means of a light-weight line, previously floated through with a rubber-ball float as a leader. In some cases, the line was pushed through with a steel rod.

After the cable had been threaded through, a three-section cleaning tool was attached to it and drawn through the line by means of a 16 hp.. gasoline motor-driven winch. This tool consists of a number of small plows and scrapers supported from the ends of strong leaf springs and follower brushes. At both ends of the section to be cleaned the cables were guided under pulleys, held in place by adjustable pipe or channel frameworks. This was set up in the form of an "H" with the legs driven solidly into the ground, the horizontal bar forming the pulley axle.

After the cleaning tool had been pulled through the section, it was reversed and dragged back by a winch at the starting point. This procedure was repeated several times until all deposits were entirely scraped free. Finally, the section was flushed out with water.

Depending on the extent and hardness of incrustation, from two to eight passages were required to clean a section. Occasionally, where deposition is severe, scrapers as small as 2 in. in diameter were used for the initial operation. Larger tools were inserted as work progressed until the full-size unit passed through.

Continuous lining deposited

Prior to lining, careful measures were taken to eliminate all surface moisture. This was done by use of a small squeegee made up of eight rubber disks which fitted tightly into the pipe and were mounted concentrically on a steel shaft. Two passages through the section usually were required.

A ¼-in. conveying cable and a rubber-insulated electric conduit, temporarily taped together, were then drawn into the section to be lined. This cable was used to pull the cathode while the conduit carried direct current from the generator to the traveling cathode. The cathode consisted of a 2-in. copper tube cantilevered behind five concentrically mounted fabric disks. The disks not only centered the cathode in the pipe but also permitted flow of emulsion through "U" notches on the circumference. Since the disks traveled ahead of the cathode, newly deposited lining was not scratched, marred or otherwise damaged.

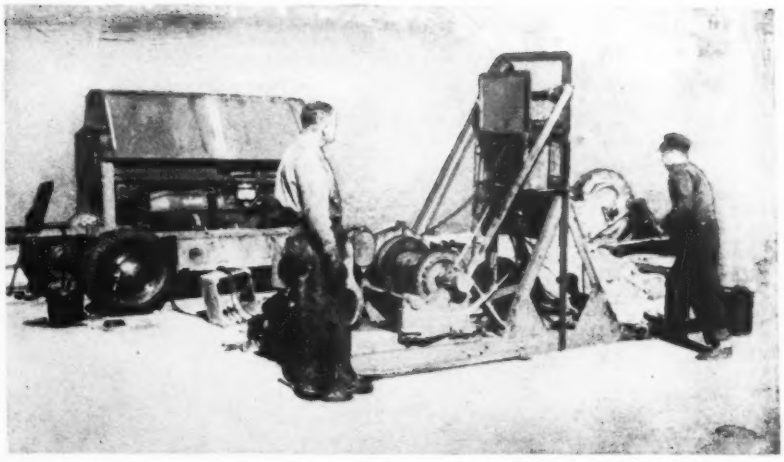


Fig. 2. A portable, sledge-mounted, gasoline motor-driven winch and hand reel were used to actuate the traveling cathode and wind in the electric conduit. The ammeter and voltmeter permitted control of the lining process.

A vented cap was placed on the end of the line where the cathode was inserted and an up-turned bend joined to the other end with a mechanical coupling. The line was then filled with a mixture of about one third patented bitumen from a tank trailer and two-thirds water. From time to time small amounts of emulsion were added to replace asphalt given up in lining and to maintain a full pipe.

The pipe was grounded to the positive pole of a d.c. generator and the negative pole of the generator was connected to the electric-conduit reel. With this arrangement, the applied current (40 amp. and 70v.) passed from cathode through electrolyte to pipe, depositing bituminous particles on the interior surface. With electric current maintained constantly in this circuit, amperage dropped slowly to a value of about 10, the point at which coating was complete. Thus, the ammeter reading governed movement of the cathode. As cathode was advanced in short steps, the amperage immediately rose and gradually fell as deposition progressed. This operation was continued until the cathode appeared at the outlet, thus completing a continuous lining in this section. In one instance, 332 lin. ft. of 4-in. pipe on the Highlands project were lined in about 90 min.—a rate of 3.7 fpm.

House connections back-flushed

After the cathode had been withdrawn, emulsion was pumped from the lower end of the section and all house connections and laterals were back-flushed to prevent the solution from entering house plumbing when the main was returned to service. Stoppages in house services seldom occur as bitumen does not adhere permanently to uncleaned pipe.

Similarly cleaned and lined, extracted pipe lengths were replaced by means of mechanical sleeves after adjacent sections were treated. The final operation consisted of backfilling pits and replacing pavement.

The Highlands main-rehabilitation work included about 6,000 lin. ft. of 4-in. and 5,000 lin. ft. of 6-in. pipe. respectively. At present another project for cleaning and lining additional mains is under consideration.

Louis Loder, Jr. is chairman of the Highlands water department and Craig Finnegan is borough engineer. The rehabilitation work was done by the Pittsburgh Pipe Cleaner Co. of New York of which Thomas N. Robinson is district manager, and Paul Pruss, general service superintendent.

Fig. 1. Vitrified clay liner plate protects concrete piers from acid waters in western Pennsylvania.

Bridge Piers Faced With Clay Liner Plate

Henry K. Fluck
Field Engineer, Latrobe Construction Co.
Latrobe, Pa.

Contents in Brief—Confronted with a scarcity of radial brick for facing concrete bridge piers, a Pennsylvania highway contractor secured permission to substitute vitrified clay liner plate. In addition to protecting the concrete from highly acid waters, the liner plate simplified construction and speeded the work.

EXPEDITING construction by the substitution of one building material for another in critical short supply is an old story. But such a case which occurred last year on bridge construction in western Pennsylvania, is worthy of note because of the simplicity and economy of construction as well as the improved appearance and durability of the completed structure.

Specifically, the job involved facing the concrete piers of a five-span, 369-ft. continuous I-beam bridge, with a material impervious to severe concentrations of sulphates existing in the water of the stream to be bridged.

No brick available

Radial brick had been specified for the circular pier columns and web-walls. The supply of this brick, however, was exhausted so vitrified clay liner plate was substituted as a time-saving expedient in completing the project.

The bridge was part of a $1,600,000 highway relocation project on U. S. Highway 22, east of Pittsburgh. The new location runs through the Loyalhanna creek reservoir watershed which, in that locality, contains ground and surface water so high in sulphates that it could not be used in mixing or curing concrete. Chemical analyses showed the total sulphur percentage to be 0.21, and a hydrogen ion concentration (pH value) of 2.0.

At the start of the project, in March 1946, we set up a 540-calendar day schedule for its completion. Scarcity of brick for facing the piers threatened to extend the job beyond schedule limitations and into the winter months of 1947. On the other hand, service had been exceptionally good in procuring vitrified clay liner plates for the protection of eleven small concrete arches and arch culverts in the project.

A conference with a manufacturer of vitrified clay liners disclosed that 9x1¼x18-in. liner plates, cast to a 55-

Fig. 2. Arch culverts on the same contract also were protected by vitrified-clay liner plates. They extended from 2 ft. below streambed to 3 ft. above and were placed in the same way as plates on the bridge piers.

in. radius, could be furnished for facing the piers, providing the construction specifications could be altered to permit their being substituted for the radial brick.

Plans were re-drafted

The problem of altering the specifications in this respect involved a re-drafting of plans. Each pier had columns of a different radius and different taper, requiring individual sketches. These were prepared and sent to the Pennsylvania Department of Highways and the Public Roads Administration for approval. After several revisions, approval was received from both the state and PRA. Five weeks later we had the plates on the job.

Forms for the piers were built of timber, in conventional manner, with the liner plates tacked to the inside of the forms by bending six nails over each plate. By taking advantage of the ¼-in. permissible joint between plates it was possible to use one standard size plate and to adjust them for the decreasing radius of the columns as they were built up from the footing.

Joints between the liner plates were sealed with bituminous plastic cement before pouring the concrete. After stripping the forms the exposed vitrified clay facing was washed with acid to remove all mortar seepage.

There was considerable skepticism that the use of vitrified clay liner plates would detract from the beauty of the completed bridge. But the opposite was true—by placing the plates with their 9-in. dimension horizontal and staggering all joints, the finished appearance was an improvement over the usual radial brick facing used in this area where streams carry high sulphur concentrates.

Installation of the liner plates was faster and more economical than brick facing. By using the liners, concrete in the piers could be poured in greater lifts, thus simplifying the work and reducing construction costs. Five tongues running the full length of each plate insure their permanent adhesion to the concrete.

Although specifications permitted the use of brick or vitrified clay liner plate for the protection of the eleven concrete arches from a point 2 ft. below streambed to 3 ft. above, we used the liner plate on those structures for the same reasons that applied to its being used on the bridge piers.

All vitrified clay liner plates for the bridge piers and arches, totalling 6,800 radial plates and 21,000 flat 9x18-in. plates, was furnished by the Robinson Clay Products Co., Akron, Ohio.

Engineers and contractors

Carl Kumrow and James Brownfield were construction superintendents for the Latrobe Construction Co., contractor for the entire project. The author served as engineer for the contractor, and Howard Hoffman was project engineer for the Pennsylvania Department of Highways.

Bundle Reinforcing Saves Materials

REINFORCING BARS placed in bundles instead of having the usual spacing saves depth and width in concrete joists supporting the deck of a small bridge recently built in Whatcom County, Wash. In this manner, four bars (two 1⅛-in. square bars and two 1¼-in. square bars) were placed in a joist only 7¼ in. thick, thus saving at least 4 in. in thickness. A similar—but smaller—reduction was possible in the depth of the joist. Thus, material costs are decreased due to less concrete yardage and also less dead weight to support.

According to the designer, an important essential in the use of bundles of reinforcing is that each bar be individually well anchored. In the Whatcom County bridge, the top two bars are 1⅛ in. square and they are stopped 2½ ft. apart with complete hooks. The bottom two bars are 1¼ in. square with one bar being bent so that it extends some 3½ ft. into the deep joist haunch at the columns, ⅜-in. stirrups being provided at the bend point. The remaining bar extends to the column center line. Thus, secure anchorage is provided for each bar.

Before employing this design the designer had earlier made up two beams to test the strength of bundles of reinforcing. One of these beams was reinforced by 1-in. square bars

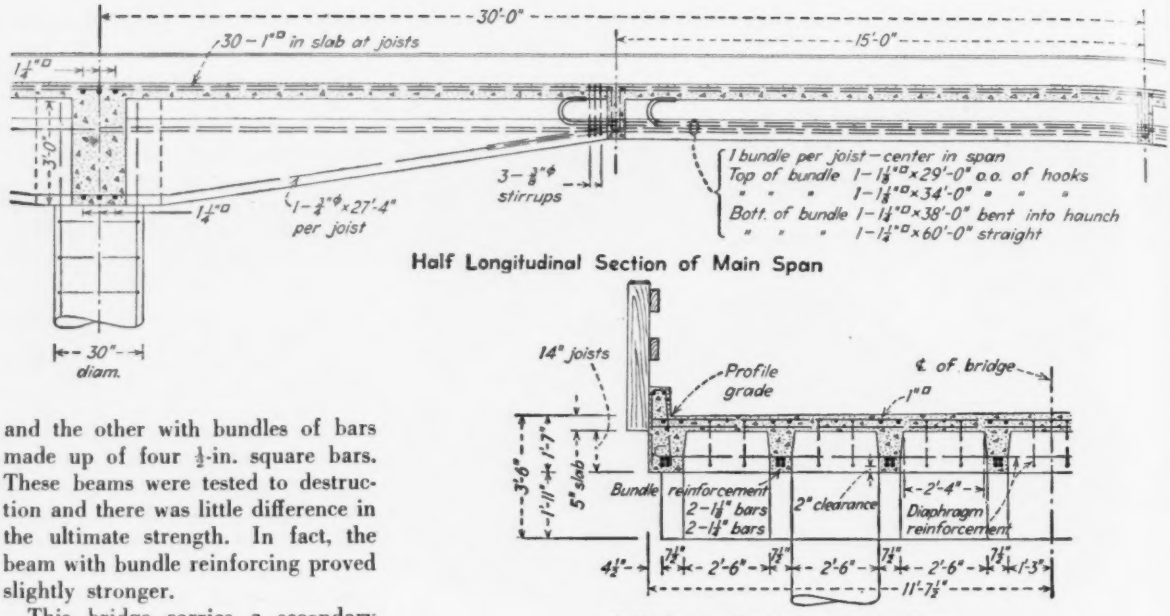


Fig. 1. Use of bundles of reinforcing bars in beams of a small bridge in the State of Washington allows less material to be used. Note that individual bars are of different lengths to provide adequate opportunity for effective anchorage.

and the other with bundles of bars made up of four ½-in. square bars. These beams were tested to destruction and there was little difference in the ultimate strength. In fact, the beam with bundle reinforcing proved slightly stronger.

This bridge carries a secondary road in northwestern Washington across a ravine. It is 120 ft. long and is supported by two bents of two circular columns each, the bents being located at the quarter points. Thus, the main span is 60 ft. long, and it is to support this span that the bundles herein described were used. To support the shorter spans, bundles consisting of three ¾-in. round bars were used.

The bridge was designed so that standard steel pan forms could be used. Thus the clear spacing between the beams is 30 in. at the bottom with a chamfer so that the top width is 28 in. Columns are 30 in. in diameter and standard steel forms were also used for them. Specifications call for AASHO H15-44 loading, intermediate grade deformed bars, and Class A concrete.

A large-scale use of bundle bars is reported in an *Engineering News-Record* article on the design of the Quitandinha Hotel in Petropolis, Brazil, in which reinforcing bundles were used in rigid frames of 100-ft. spans over an ice skating rink (*ENR* Jan. 10, 1946, vol. p. 24).

The bridge described herein was designed for Whatcom County, Wash., by Homer M. Hadley, consulting engineer, Seattle, Wash.

Cities Operate War-Built Airports

Confident of continued rapid aviation growth, many U. S. cities are maintaining airports larger and more elaborate than needed for current air traffic according to a recent survey by the International City Manager's Association.

These cities generally are among those which leased airports to the federal government for wartime use. The Army and Navy in most cases enlarged these fields or built new ones and now are returning them to municipalities through the War Assets Administration.

Of 23 such airports studied by the Association, 18 are larger than the cities would build themselves. With only one exception, however, these cities intend to operate the fields at their expanded size despite high maintenance costs. The airports surveyed belong to localities ranging in size from Lincoln, Cal. (2,000 pop.) up to Milwaukee County, Wis. (587,000 pop.).

Seven of the cities surveyed expect airport revenues this year to at least equal operating expenses. Big Springs, Tex., for example, expects landing fees and other revenues to yield $46,000, whereas budgeted operating costs are only $39,000. The Big Springs airport, with three commercial hangars and four hard-surfaced runways, is much larger than the city of 13,000 population would build itself.

Other cities expecting airport revenues to exceed expenses this year are Chickasha and Shawnee, Okla.; Liberal, Newton and Parsons, Kan., and Stockton, Cal. Liberal is the only city of the 22 which does not plan to utilize all its expanded airport immediately. The military field is far larger than is currently needed.

Fifteen of the airports studied depend for revenues mainly on gas and oil sales and building rentals. Seven of the 14 which are scheduled air carrier stops report revenues from landing fees. Twenty cities and Milwaukee County, Wis., are operating their own airports, while Jacksonville, Fla., and Lincoln, Cal., are leasing their fields to private operators.

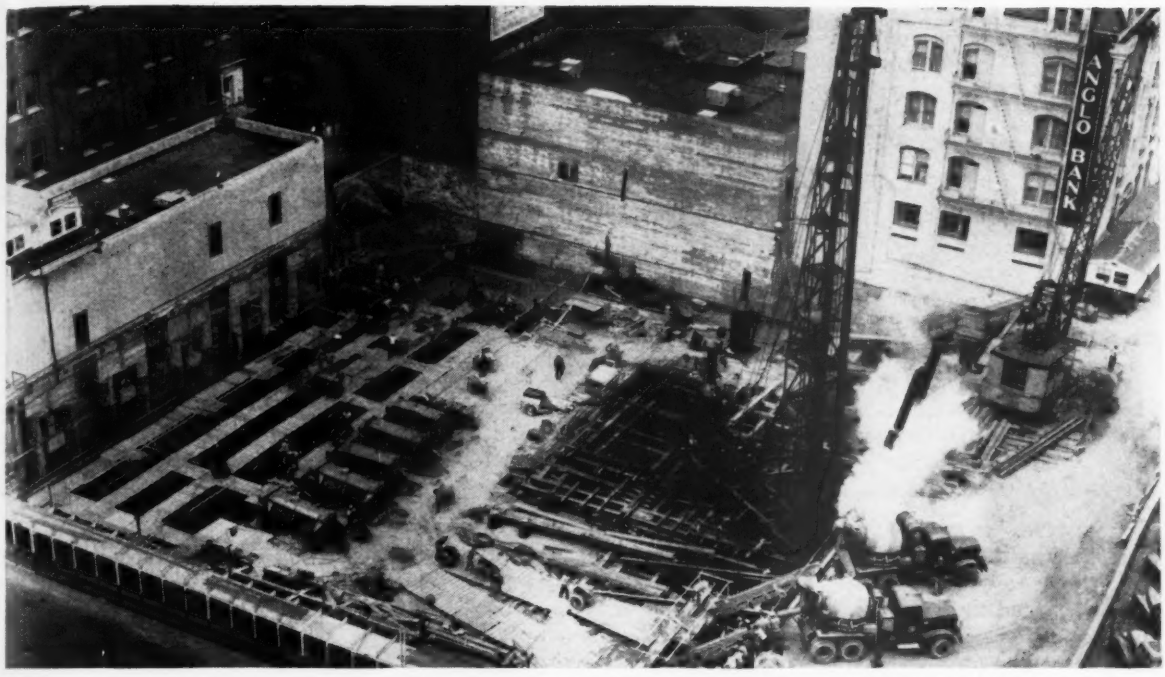


Fig. 1. Driving steel tubes in the portion of the foundation where loads will range up to 18,300 psf. Settlement of tubes and of a slab forming the rest of this foundation is expected to be uniform.

Steel Tube Piles For 100-Ton Loads

***Contents in Brief**—Concentration of heavy equipment and walls in a new telephone building at Oakland, Calif., results in loads up to 18,300 psf. in part of the foundation area to be supported by steel tubes driven to 80-ft. depths and then emptied by air-and-water jets. Filled with concrete, these tubes are to take loads up to 100 tons each, with a similar long-time settlement rate to the 5-ft. concrete slab under remainder of the building, carrying only one-third the loading.*

CO-AXIAL CABLES and other facilities for handling rapidly increasing business in central California have led to construction of a new telephone equipment building for The Pacific Telephone and Telegraph Co. at Oakland, Calif. Near one exterior wall a large concentration of walls around shafts, stairways and flues as well as fire walls give rise to heavy loadings along one side of the building while only nominal loads will be carried by the remainder of the foundation. As the heavier loads occur along a property line the designers were given the problem of providing a foundation on which this unbalanced loading would not produce uneven settlement of the building.

The importance attached to uniform settlement, even on a long-term basis, was increased by the fact that the new building will be 288 ft. high; a lever arm that would amplify unequal settlement. The foundation area is 139 x 144 ft., and the heavy loads, ranging from 15,000 to 18,300 psf., occur in one corner of the building in an area of 28 x 126 ft. Over the remainder of the foundation the loads will range up to 9,000 psf. with an average of 6,000 psf. All these loadings are total dead load plus 60 percent of live load.

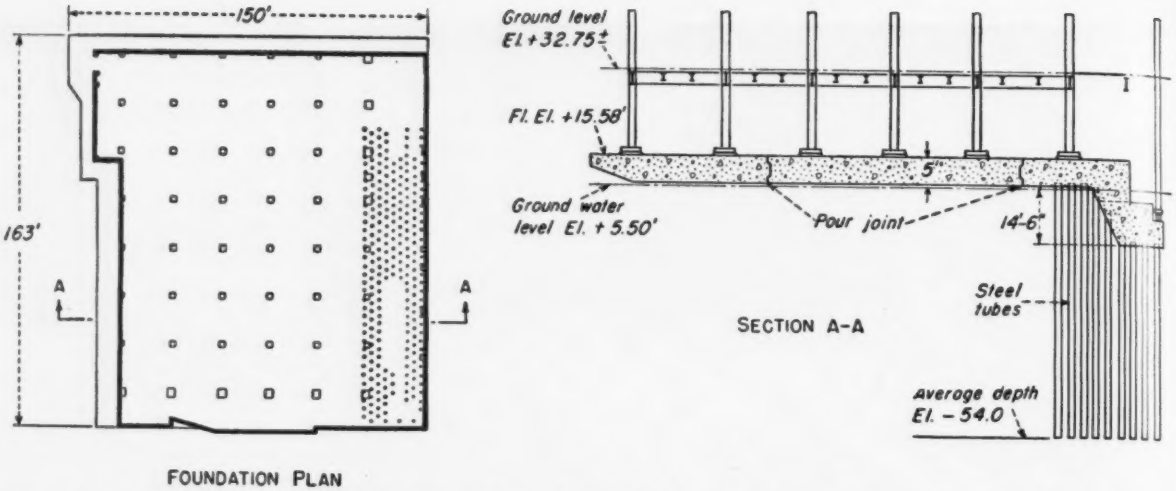
In considering the type of foundation best suited to the concentrated loads, three kinds of supports were considered, namely, precast concrete piles, large concrete cylinders of the caisson type and steel tubes to be driven with open bottoms and later emptied so they could be filled with concrete.

In comparing and contrasting these three methods, the precast concrete piles were eliminated first, because of the possibility that their driving on close spacing and with the aid of jets might disturb the foundation balance temporarily, with an unknown effect on amount of ultimate settlement.

Caissons too costly

The next type to be abandoned was the large concrete caissons. These would concentrate loadings to a higher total than was desirable where no rock bottom could be reached and would be relatively costly where groundwater level is high. Finally, test borings indicated that frictional resistance would be the principal factor in supporting the load.

Under these conditions and when it appeared that the maximum friction would be developed by the steel



FOUNDATION PLAN

Fig. 2. The foundation includes a heavy mat and closely spaced piles under a part of the area to take the heavy loads.

tubes because they would present a greater total area in contact with the soil than would the relatively small number of larger cylinders, the steel tubes were given preference.

The steel tubes had the great advantage that they could be driven with practically no disturbance to adjoining soil pressures because of the extremely small displacement involved in putting down an open cylinder with walls only ⅜ in. thick. Thus the tubes could be driven on a close spacing and yet, after being poured full of concrete with suitable steel reinforcing, could carry a heavier loading than precast concrete piles of corresponding size and length.

Examination of the test boring logs showed a stratum of dense sand with a suitable bearing value at a depth of 80 ft. below the surface. Laboratory tests on intervening materials indicated that frictional resistance would be such that the total permissible load on 18-in. steel tubes put down to this depth would be about 100 tons per tube. This bearing value is sufficient for the most heavily loaded area with tubes in a staggered plan, 3½ ft. apart in one direction and 3 ft. 1 in. in the other. This spacing gave a net clearance of 2 ft. between the edges of adjacent steel cylinders.

Shoring and falsework

Part of the preparatory work on the foundation was to provide support for the adjoining bank building and to prevent caving along street and property lines. Accordingly, before excavation began, a line of 10-in., 42-lb. H-beams were driven as piling on 6-ft. centers along the lines where bulkhead support was needed. With these in place, as excavation was carried on, horizontal lagging was tucked in between flanges of the H-beams. In the upper portions the plank lagging thickness was 2 in.; at greater depths, 3 in. The H-pile lengths varied from 30 to 50 ft. and were selected so that each one would extend 8 to 10 ft. below the bottom of the excavation that was to follow.

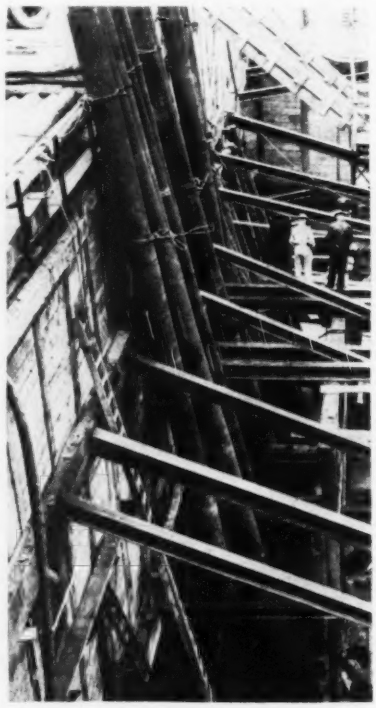


Fig. 3. Shoring at left consists of 10 in., 42-lb. H-beams on 6-ft. centers driven before excavation started and lagged as it progressed.

Driving was hard, and each pile required up to 3,000 blows of the Vulcan No. 1 hammer.

Walers consisted of doubled 10- or 12-in. H-sections set side by side. Shoring was 10- or 12-in. H-sections or 12 x 12 timbers, as required. Provision was made for later moving the shores to clear the piledriver when driving the 18-in. tubes. Walers were carried on brackets welded to the steel bulkhead piles. Bulkhead piles were also utilized as partial support for the piledriver in the hole. By capping them at the street level and putting crane mats on the cap, they also helped support the weight of the crawler crane on top. Walers and shores were handled with either the crawler or truck cranes at surface level. Shores were provided with support at the lower end by casting stub H-sections into the concrete slab in the middle of the site where no pipe piles were to be driven.

Driving 18-in. steel tubes

Pouring the concrete slab in that part of the foundation not to be supported on piles was done as soon as excavation had been completed and before driving the steel tubes. This program had the advantage of providing a working surface from which to handle the deeper foundations. The piledriver that put down the 18-in. tubes started from the concrete slab and advanced over the deep foundation area on falsework piling driven by a hammer working in hanging leads slung from a crane at ground level.

A total of 246 of these tubes from

48 to 60 ft. long were needed for the job. They were brought to the site at a rate such that a small supply would always be on hand, and were stored by standing them upright, leaning against the edge of the bulkhead in a spot where they would not be in the way but would be handy to the pile-driver.

At the outset an ordinary steam hammer was used for driving, but because of the extremely tight formation in the compacted material a special single-acting No. 0 Vulcan hammer using a 10,000 lb. ram on a 3½-ft. fall was brought on the job. This gave very satisfactory results on long-continued heavy duty, and the driving rate was at almost twice that of the lighter rig. Despite the close spacing, the tubes went down without any interference whatever with those previously driven. Moreover, because of the uniformity of the foundation material they went down straight with negligible deviation from the vertical.

For two reasons care was taken to drive all of the tubes to exactly the same depth below the surface. First, with this penetration the stratum of high-resistance foundation material would be reached throughout the heavily loaded area and, second, by having all the tubes terminate in the same formation they would all develop the same bearing value and equal settlement could be expected. Calculations of expected total settlement in a 20-year period predict a difference of only ½ in. between amount of settlement of the tubes and the 5-ft. slab.

Although nothing beyond the usual practice of lowering a pipe into the tubes through which an air and water jet could be admitted was involved in cleaning the tubes, more forethought and arrangement of equipment was required to restrain and catch the ejected material. The plan adopted was to use a bonnet or deflector put over the top of the tube where it would deflect the spouting stream into a skip alongside. The jet pipe went down through a hole in the bonnet.

Despite the fact that most of the water and a good deal of the solid material overflowed, the 5-cu. yd. skip retained enough to be practicable. Overflow material was later hand-shoveled into the skip as close spacing of the piles made it impossible to use equipment efficiently.

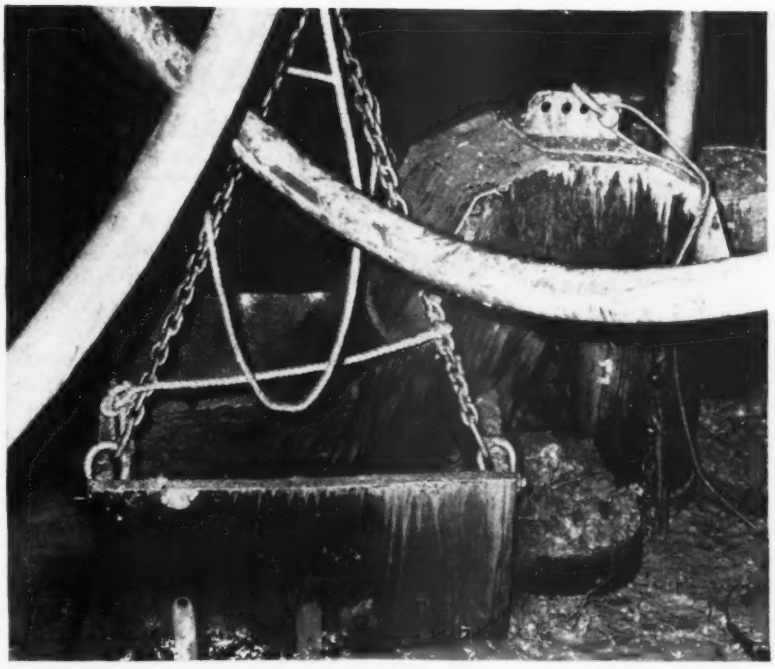


Fig. 4. Deflector bonnets were placed over the pipe piles during the jet cleaning operation to divert waste material into a skip.

Jet water used in emptying the tubes was recirculated from the sump in the lot, and the water reused as much as possible. However, a mud slurry kept accumulating which was too heavy to pump and too liquid to shovel. A mud pump was set up to lift this slurry out of the site. Danger of clogging sewers made it inadvisable to dump this slurry into gutters, and it was decided to haul it away in tank trucks.

Groundwater level at this building site occurs at a depth of about 28 ft. below the surface. In cleaning out contents of the tubes it was desired to leave enough material at the lower end to serve as a seal preventing inflow of groundwater. Hence, in removing tube contents the work was stopped some 3 ft. above the bottom.

Compacting material remaining in the bottom of the tube, preliminary to placing concrete, was effected by a 20-ft. length of 8-in. H-beam to the lower end of which a 16-in. circular plate had been welded. This H-beam, lowered by a crane line, served the dual purpose of cleaning off anything adhering to the inner face of the tubes and tamping the material remaining in the tubes at the bottom. The tamping was done by dropping the H-beam section repeatedly through a distance of about 20 ft.

Immediately after cleaning out, the tube tops were covered by placing inverted half-barrels over them to prevent debris from falling down inside. As cleaning operations moved out of the way, the half-barrels were removed, the tubes given a final inspection with a light and a mirror, the reinforcing installed (four 1-in. rounds fastened with ⅜-in. ties on 12-in. centers) and concreting was carried out.

The building is being constructed for The Pacific Telephone and Telegraph Co.; R. I. Blake is building and equipment engineer; Walter W. Eckley, building engineer in charge of construction; and Andrew M. Bryne, resident engineer. Harry A. Thomsen, Jr. and Aleck L. Wilson are the architects. The foundations and superstructure were designed by John J. Gould, structural engineer, San Francisco, making use of test data developed by Dames & Moore, foundation engineers. Contract for putting in the foundation was held by the Dinwiddie Construction Co., George Horne, job superintendent. Contract for supplying and placing the steel tube piles was held by the Raymond Concrete Pile Co., Ed Whiteley, job superintendent.

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

More on the Smog Nuisance

Sir: Your news item about Los Angeles smog (*ENR* Feb. 19, 1948, vol. p. 240) tells only part of the story. Because the smog problem will likely appear in many more cities careful analysis is desirable. Certain significant facts should be noted at the outset.

Note that the public complains not about smoke (carbon in the atmosphere) but rather about gases that inflame and irritate eyes, nose and throat. Note that the complaints come from street level and lower floors of buildings; not from upper floors.

Observe, too, that Los Angeles, dubbed "the smog capital," is also the automobile capital. Millions of cubic feet of exhaust gases from gasoline engines are daily discharged in this city at street level. These gases consist principally of carbon dioxide, carbon monoxide, oxides of nitrogen, aldehydes, and sulphur as well as oxygen and nitrogen. These are all odorless except the sulphides and aldehydes; it is probably some of the latter (formaldehyde, for example) that are the eye, nose and throat irritants.

What are the remedies? So far no progress has been made toward neutralizing the dangerous gases in motor vehicle exhausts. In England and on the continent an exhaust gas scrubber has been used on diesel locomotives in mining operations with such good effect that the exhaust is breathable even in confined air as in a mine. In this country one or two mines have been experimenting, not with scrubbers but with oxygen injected into the exhaust lines or combustion chamber. However, nothing commensurate with the scope and importance of this problem has been undertaken.

As population increases and with the consequent increase in automobile and truck use, the health menace from exhaust gases will increase correspondingly. Something should be done to force the automobile industry and allied interests to undertake intensive study and experimentation aimed at developing a scrubber or neutralizer that can be attached to every automobile and truck as regular equipment. It would be greatly to the advantage of the automotive industry to initiate a move of this sort before the industry finds itself confronted with legislation restricting the use of motor vehicles in thickly populated areas.

F. D. HOWELL
Consulting Engineer,
Los Angeles.

Alaska Highway Relocations

Sir: I have just gotten around to read the letter by R. E. Royal of the Public Roads Administration (*ENR* Dec. 25, vol. p. 892) concerning perma-frost in relation to the relocation of 500 miles of the Alaska Highway, and your footnote. I did not have any experience on the Alaska Highway itself but in 1943 was inspector and progress engineer on the Haines Military Cut-Off to the Alaska Highway and have traveled over sections of the Alaska Highway.

In the first place let me call attention to the fact that there is probably no inconsistency between Mr. Royal's statement and the report of the St. Paul District Engineer. The latter report states "necessitated rerouting nearly 500 miles of the roadway in 1943." This evidently refers to a rerouting of some of the pilot roads laid out in 1942 (which Mr. Royal admits) while Mr. Royal states "not a single mile of the highway as built in 1943 has been relocated for this reason." One statement is "before the fact" and the other "after the fact."

In the second place, unless you have quoted only part of the statement, the St. Paul District Engineer does not state that permafrost caused the relocation, but uses the term, "sliding, cracking, and shrinking top soil necessitated rerouting."

To my knowledge we did not encounter permafrost on the Haines cut-off but did have trouble in several places from sliding and cracking. One place in the cut-off about five miles north of the Alaska British-Columbia line caused closing of the road during construction several times and I am told caused its closure again in 1944. At this point the road was located around the end of the ridge between two streams running into the upper end of the Klehini River. The end of the ridge at the Klehini River gorge was apparently static at the angle of repose and when the road cut was made by excavating above and side casting over the lower slope, we had several slides from above after heavy rains had saturated the soil, which, as I recall, was a river silt.

However we had in several places on the Haines cut-off near the Indian village of Klukwan a type of slide which I had never before encountered. Any one who has seen streams from melting glaciers will recall the milky appearance of the water caused by the rock flour ground up by the glaciers in suspension. Apparently this rock flour which works into the gravel beds of the streams acts as a lubricant. When super-saturated and in this condition even very flat gravel slopes will flow like lava. One evening after a two weeks rain two of us were returning from an inspection trip and encountered one of these slides. The surprising fact was the flatness of the slope which I would estimate as not more than five percent. Yet acres and acres of this saturated gravel was slowly moving with boulders up to a foot in diameter rolling over and over, the whole mass flowing like very wet concrete. The area was heavily wooded but the moving gravel was flowing around the trees like wet concrete around reinforced rods.

These very flat slides were apparently quite frequent in this section and we were told that several years ago an Indian village was overwhelmed one night by such a slide and so completely buried that no attempt was ever made to excavate it. After observing the phenomenon at close quarters I do not doubt the tale.

I suspect that many of the relocations on the Alaska Highway were made for such conditions as these rather than from permafrost.

SYDNEY L. RUGGLES
Construction Engineer
Federal Correctional Institution
Danbury, Conn.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Structural Design Handbook

MANUAL OF STRUCTURAL DESIGN—Third Edition, by Jack Singleton. 336 pp. H. M. Ives & Sons, Topeka, Kansas. $6.

More than 100 pages of new data have been added in revising this collection of original tables, design charts and specifications that many engineers have found useful in the solution of an unusually-wide range of structural design problems. Included in the additional material are the 1946 simplified list of wide-flange shapes, data on welding and on aluminum, tables of fixed-end moments and information concerning roof decks. In addition, design specifications have been brought up to date.

Making Alignment Charts

ELEMENTS OF NOMOGRAPHY—By Raymond D. Douglass and Douglas P. Adams, 209 pp. McGraw-Hill Book Co., New York 18 and London. $3.50.

This book deals with the preparation and use of alignment charts, presenting seven elementary types. A feature is the inclusion of the circular nomograph as a separate entity. The subject is developed from the viewpoint that each type of chart considered solves a certain type of equation, as compared with the method of using the general theory of nomography to find a chart for any given equation.

Safeguarding Workers' Health

INDUSTRIAL HEALTH ENGINEERING—By Allen D. Brandt. 395 pp. John Wiley & Sons, New York; Chapman & Hall, London. $6.

Control of the environment of industrial plant employees to prevent conditions that might be detrimental to health is the province of the industrial health engineer. Working with industrial physicians, chemists and plant engineers, he determines what control steps should be taken and designs the necessary equipment. To aid in this task, the author has summarized the voluminous information now available in scattered sources. The resulting book contains practical data on evaluation and control of atmospheric health hazards; on heating, ventilation, air conditioning and illumination; on regulation of radiant energy and industrial noise; and on plant sanitation.

Guide to Effective Lighting

FLUORESCENT LIGHTING MANUAL—Second Edition, by Charles L. Amick. 318 pp. McGraw-Hill Book Co., Inc., New York 18 and London. $4.

A convenient reference useful in solving problems arising in fluorescent lighting practice, the manual has been revised to include information on new types and sizes of fluorescent lamps, auxiliary equipment improvements and recent lighting techniques. New design data have been incorporated and sections have been added on lighting comfort.

Bargaining by Professionals

INSIGHTS INTO LABOR ISSUES—Edited by Richard A. Lester and Joseph Shister. 368 pp. The MacMillan Co., College Dept., New York. $4.

This small book is made up of several chapters each by a different author or authors on many of the major labor issues of today. The main reason for including comment on it in these pages is the fact that it contains a chapter on Collective Bargaining by Professional Societies by Herbert R. Northrup of the New York School of Social Work, Columbia University, who also wrote "Unionization of Professional Engineers and Chemists" (*ENR* Feb. 6, 1947, vol. p. 223). In the book here under discussion, Mr. Northrup includes the activities of the American Nurses Association and associations representing teachers as well as the collective bargaining activities inaugurated by the American Society of Civil Engineers and the American Chemical Society and, years ago, by the American Association of Engineers.

Mr. Northrup disagrees sharply with the ASCE in its efforts to have professional employees classified according to the training each individual has received rather than according to the job he holds. In this he has both logic and the National Labor Relations Board on his side. The Taft-Hartley Act classifies professional men on the basis of the type of work they are doing.

In his conclusions, Mr. Northrup gives more substance to a conflict between unions and professional societies than appears to be there, at least in the engineering field. Certainly no engineering society at the present time is attempting to perform the functions of a union or to exclude unions from the life of professional engineering employees even though the action the ASCE took a few years ago might have been so interpreted at that time. Aside from this, however, Mr. Northrup's observations in his "Conclusions and Implications" are thought provoking.

Safety Equipment

BEST'S SAFETY DIRECTORY—1948 edition, 494 pages. Alfred M. Best Co., Inc., New York 7, N. Y., $5.

Using safety as a theme, this large book lists what equipment is available, tells briefly how to use it and gives the companies manufacturing items ranging from first aid bandages to industrial locomotives. Many things listed are primarily for industrial use but the fact that they are only infrequently needed on construction makes a central source of information even more valuable.

"Safety" is given quite liberal interpretation to include such items as waste cans, gloves, paints, roofing, conveyors and cranes, as well as the goggles and safety clothing one would expect to find in such a book.

It's a book well worth its price on any construction job.

Heating and Cooling Data

HEATING AND VENTILATING'S ENGINEERING DATABOOK—by Clifford Strock. 570 pp. The Industrial Press, New York 13, N. Y. $7.

Intended for use by contractors, architects, plant engineers and engineering students, as well as by specialists in the heating and ventilating field, this pithy reference work presents useful data needed in design

with only brief explanatory text. The book is divided in ten sections—heat and moisture in air, fuels and combustion, piping, air handling and ventilation, heating and heat transmission, cooling and air conditioning, motors and drives, contract law, mathematical data and drafting room practice, and terminology. It includes information on the heat pump, air sanitation, refrigeration, electrothermal storage, snow melting, heating with diesel engines, solar water heating and radiant heating.

Records of Engineers

WHO'S WHO IN ENGINEERING—Sixth Edition. 2,357 pp. Lewis Historical Publishing Co., New York. $15.

This new edition of Who's Who in Engineering is greatly enlarged over the 1941 edition, the total listing of biographical records of engineers amounting to about 16,000. Great care was exercised in getting better coverage of the engineers who came within the specifications set up for inclusion in the volume. Similarly, a special effort was made to get individual records accurate. As a result the new edition is much more complete than earlier ones.

A valuable but little known section of this book is its listing of national and local engineering organizations with their officers and membership.

Miscellaneous Notes on Booklets and Reprints

GUIDE FOR HOTEL FIRE SAFETY LAW, adopted by the National Fire Protection Association in 1948, presents recommendations for hotel construction, arrangement, equipment, operation and maintenance to provide reasonable protection against fire hazards. The guide can be adapted for municipal use with minor changes where necessary. It can be obtained for 50c. from the association, 60 Batterymarch St., Boston 10, Mass.

"PLANNING THE EXPANSIBLE HOUSE," a 32-page illustrated booklet published by the Housing and Home Finance Agency, is devoted to suggestions for designing a house that can be enlarged as family needs grow. Six schemes are presented for adding rooms at minimum cost. Copies may be obtained at 20 c. each from the Superintendent of Documents, U. S. Government Printing House, Washington 25, D. C.

COST-CUTTING METHODS of house construction are outlined in Here's a Better Way to Build, which can be obtained for $1 from the National Retail Lumber Dealers Assn., 302 Ring Building, 18th and M Streets, N. W., Washington, D. C. The booklet is based on the industry-engineered homes program sponsored by this association and the Producers' Council. Use of modular coordination and standard, readily available products, precut and pre-assembled where advantageous, is urged.

USE OF AIRCRAFT IN THE CONTROL OF MOSQUITOES is the title of a booklet on dispersal of insecticides, prepared by the American Mosquito Control Association, and designed to provide complete information on equipment and procedures. Copies at $1.50 are available from the association at the New Jersey Agricultural Experiment Station, New Brunswick, N. J.

New Engineering Books

SOIL MECHANICS IN ENGINEERING PRACTICE—By Karl Terzaghi and Ralph B. Peck. 566 pp. John Wiley & Sons, New York 16. Chapman & Hall, London. $5.50.

CENTRIFUGAL AND AXIAL FLOW PUMPS—By A. J. Stepanoff. 428 pp. John Wiley & Sons, New York 16. Chapman & Hall, London. $7.50.

STRESS ANALYSIS AND DESIGN OF ELEMENTARY STRUCTURES—By James H. Cissel. Second Edition. 419 pp. John Wiley & Sons, New York. Chapman & Hall, London. $5.

INSIGHTS INTO LABOR ISSUES—Edited by Richard A. Lester and Joseph Shister. 368 pp. The MacMillan Co., College Dept., New York. $4.

THE CORROSION HANDBOOK—Edited by Herbert H. Uhlig. 1,188 pp. John Wiley & Sons, New York. Chapman & Hall, London. $12.

PLANNING INDUSTRIAL STRUCTURES—First Edition—By Clarence W. Dunham. 481 pp. McGraw-Hill Book Company, New York 18, and London. $6.

STRENGTH OF MATERIALS — By Joseph Marin. 464 pp. The MacMillan Co., New York. $4.75.

ELECTRIC POWER AND GOVERNMENT POLICY —860 pp. The Twentieth Century Fund, 330 West 42nd St., New York 18. $5.

RADIANT HEATING — First Edition — By Richard Woolsey Shoemaker. 306 pp. McGraw-Hill Book Co., New York 18, and London. $4.

Reports and Pamphlets

SOUND INSULATION OF WALL AND FLOOR CONSTRUCTIONS — Supplement No. 2 to Report BMS17—For Sale by Superintendent of Documents, Washington 25, D. C. 10¢.

STANDARD ORDINANCE FOR CHIMNEY CONSTRUCTION—3rd Edition—National Board of Fire Underwriters. Obtainable from Robinson Clay Product Co., 2nd National Building, Akron 9, Ohio.

RAILWAYS AT WAR—Public Relations Section, Department of Railways, New South Wales, 19 York Street, Sydney, Australia.

CONSTRUCTION SURVEY SYSTEM—REPORT OF PRACTICES AND RECOMMENDED PROCEDURE—Construction Surveyors Institute, 101 Park Ave., New York 17. 5¢.

SURVEY OF WOOD PRESERVATIVES USED IN THE DIFFERENT EUROPEAN COUNTRIES BEFORE AND DURING THE WAR—Office of Technical Services, Department of Commerce, Washington, D. C. 50¢.

UDDRAG AF RAPPORT FRA EN BETONSTUDIEREJSE—By Niels M. Plum, 15 Ridebanevang, Gentofte, Denmark.

TRAFFIC IN THE BRONX — STUDIES AND RECOMMENDATIONS FOR PREVENTING CONGESTION—Office of the President of the Borough of the Bronx, Bronx County Building, Grand Concourse and East 161 Street, New York 51.

REPORT OF COMMITTEE ON CONCRETE PAVING DESIGN—Technical Bulletin No. 121, American Road Builders' Association, 1319 F St., N. W., Washington 4, D. C.

PATENTS AND HOW TO OBTAIN THEM—Publication No. 64, Oklahoma Engineering Experiment Station Publication, Oklahoma Agricultural and Mechanical College, Stillwater, Okla.

PHYSICAL PROPERTIES AND FABRICATION DETAILS OF EXPERIMENTAL HONEYCOMB-CORE SANDWICH HOUSE PANELS—Technical Paper No. 7, Housing and Home Finance Agency, Office of the Administrator Technical Staff, Washington 25, D. C.

40TH ANNIVERSARY OF WILBUR WATSON ASSOCIATES, Engineers, Cleveland, Ohio.

(Continued on page 129)

PITTSBURGH-EMPIRE
SINGLE REGISTER *Compounds*

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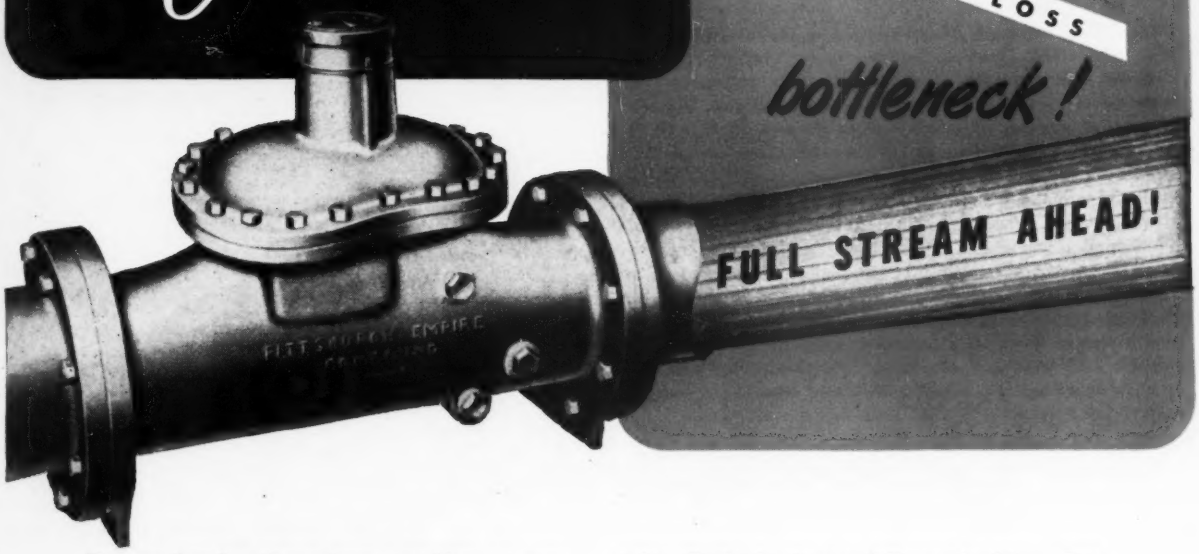

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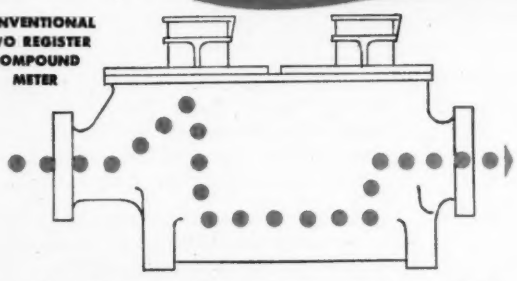
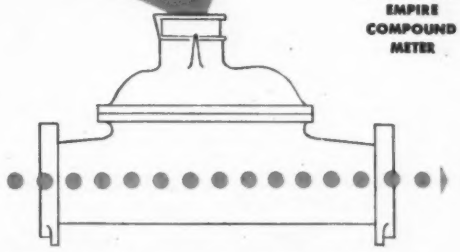
CONVENTIONAL TWO REGISTER COMPOUND METER



"OBSTACLE COURSE" FLOW

Arrow traces the pressure absorbing, wear inducing flow path in a meter having a vertically positioned propeller and lift type valve.

PITTSBURGH-EMPIRE COMPOUND METER



STRAIGHT THROUGH FLOW

Arrow shows the straight line flow stream made possible by the horizontally mounted propeller and swing action valve.

UNIT PRICES BID BY CONTRACTORS

Stormwater Channel, E. St. Louis, Mo.

OWNER: Board of Trustees, East Side Levee and Sanitary District, East St. Louis, Ill.; Homer and Shifrin, engrs.

PROJECT: *Section II:* Construction of stormwater channel with reinforced concrete bottom lining, including reconstruction and extension of existing sanitary and stormwater sewer outlets and incidental pipe culverts and headwall structures between the south end of the new B. & O. S. W. Railroad culvert northwest of the intersection of 23rd Street and Morris Ave. and the city corporate limits' line at Verlie Ave. in East St. Louis, Ill. *Section III:* Construction of stormwater channel with reinforced concrete bottom lining, including reconstruction and extension of existing sanitary sewers and stormwater sewer outlets and removal of present sanitary box sewer below the Village of Washington Park pump station and replacement of the same with three pipe siphons. Work also includes installation of new pipe culverts and headwall structures around pipe culverts and on ends of stormwater sewer outlets and removal of existing culverts and construction of new reinforced concrete box culverts at Washington Park Boulevard, 56th St. and Caseyville Ave. Stormwater channel lies in Washington Park and runs from eastern corporate limits of East St. Louis to connect at the east with existing culvert under the Alton and Southern Railroad.

CONDITIONS: All materials to be furnished by contractor. Access to job site is available by highway only. Contract stipulates that Section II be completed by July 1, 1949 and Section III, by February 1, 1949. Prevailing labor wage rates per hr. are: bricklayers, $2.50; structural iron workers, $2.25; hoisting engineers, $2.40; and common labor on heavy construction. $1.75.

BIDS: *Section II:* Three bids were received, ranging from the contract low of $203,413.00 to $220,341.50. *Section III:* Three bids were received, ranging from the contract low of $225,490.25 to $250,434.50. Contracts for both sections were awarded January 7, 1948.

LIST OF BIDDERS:

Section II:

1. H. H. Hall Const. Co., East St. Louis, Ill. (contract) $203,413.00
2. Keeley Bros. Const. Co., East St. Louis, Ill. 205,543.75
3. Moore Bros., Inc., East St. Louis, Ill. 220,341.50

Section III:

1. Keeley Bros. Const. Co., East St. Louis, Ill. (contract) $225,490.25
2. H. H. Hall Const. Co., East St. Louis, Ill. 229,667.00
3. Moore Bros., Inc., East St. Louis, Ill. 250,434.50

	Item	Quantity	Unit Prices (1)	(2)	(3)
	Section II:				
1	Channel excavation	69,800 cy	$1.10	$1.18	$1.18
2	Reinforced concrete channel lining	2,470 cy	43.70	43.00	47.00
3	Reinforced concrete headwall structures	28 cy	100.00	108.00	110.00
4	Brick masonry in manholes	580 cf	4.50	4.85	4.80
5	V. C. pipe, 8", complete in place, including excavation and backfill	620 lf	9.00	10.00	9.60
6	Concrete pipe, 12" complete in place, including excavation and backfill	200 lf	7.00	4.25	9.00
7	Concrete pipe, 15", complete in place, including excavation and backfill	115 lf	8.00	4.80	10.20
8	Concrete pipe, 18", complete in place, including excavation and backfill	60 lf	12.00	5.50	14.50
9	Concrete pipe, 24", complete in place, including excavation and backfill	65 lf	15.00	6.75	18.00
10	Concrete pipe, 27", complete in place, including excavation and backfill	10 lf	17.00	12.00	20.00
11	Concrete pipe, 30", complete in place, including excavation and backfill	25 lf	20.00	15.00	22.00
12	Concrete pipe, 36", complete in place, including excavation and backfill	35 lf	24.00	18.00	24.50
13	Concrete pipe, 48", complete in place, including excavation and backfill	20 lf	27.00	30.00	32.50
14	V. C. pipe "Ts", 8", complete in place, per piece	2 ea	15.00	13.00	14.50
15	V. C. pipe "Ls", 8", complete in place, per piece	2 ea	12.00	13.00	12.00
16	Breaking into existing manholes or sewers and making connection, per place	5 ea	250.00	125.00	480.00
17	Cast iron manholes frames and covers, per set	5 ea	40.00	45.00	48.00
18	Cast iron manhole steps, per piece	45 ea	3.00	3.00	2.40
	Section III:				
1	Channel excav. incl. removal of all existing pipes, concrete boxes and culverts	29,700 cy	$1.32	$1.20	$1.35
2	Reinforced concrete channel lining	1,950 cy	43.00	44.00	50.00
3	Reinforced concrete headwall structures	52 cy	108.00	100.00	110.00
4	Brick masonry in manholes	300 lf	4.85	4.00	4.80
5	V. C. pipe, 6", complete in place, including excavation and backfill	230 lf	3.00	5.00	6.00
6	V. C. pipe, 8", complete in place, including excavation and backfill	460 lf	3.20	8.00	12.00
7	V. C. pipe, 10", complete in place, including excavation and backfill	135 lf	15.00	10.00	12.50
8	V. C. pipe, 18", complete in place, including excavation and backfill	75 lf	16.00	15.00	9.00
9	Concrete culvert pipe, 12", complete in place, including excavation and backfill	260 lf	4.25	10.00	10.50
10	Concrete culvert pipe, 15", complete in place, including excavation and backfill	220 lf	4.80	11.00	12.00
11	Concrete culvert pipe, 18", complete in place, including excavation and backfill	35 lf	5.50	16.00	17.00
12	Concrete culvert pipe, 21", complete in place, including excavation and backfill	100 lf	6.25	20.00	19.00
13	Concrete culvert pipe, 24", complete in place, including excavation and backfill	45 lf	6.75	22.00	23.00
14	V. C. pipe tee, 8", complete in place	1 ea	13.00	5.00	12.00
15	V. C. pipe ell, 8", complete in place	1 ea	13.00	4.00	10.00
16	V. C. pipe, 10", ⅛ bend, complete in place, per piece	4 ea	20.00	6.00	14.00
17	V C. pipe, 10", slants, complete in place, per piece	4 ea	20.00	6.00	14.00
18	Breaking into existing manhole and making connections thereto	1 ea	125.00	1,500.00	1,200.00
19	"Calco", 12" or equal backwater gate, including thimble, complete in place, per piece	5 ea	55.00	50.00	75.00
20	"Calco", 15", or equal backwater gate, including thimble, complete in place, per piece	9 ea	75.00	75.00	100.00
21	"Calco", 18", or equal backwater gate, including thimble, complete in place, per piece	2 ea	95.00	85.00	125.00
22	"Calco", 21", or equal backwater gate, including thimble, complete in place, per piece	6 ea	120.00	100.00	150.00
23	"Calco", 24", or equal backwater gate, including thimble, complete in place, per piece	2 ea	135.00	150.00	180.00
24	C. i. manhole frames and covers, per set	7 ea	45.00	44.00	48.00
25	Cast iron manhole steps, per step	30 ea	3.00	3.00	2.40
26	Reinforced concrete culvert across Washington Park Blvd., complete in place	lump sum	42,800.00	43,246.00	42,350.00
27	Reinforced concrete culvert across 56th Street, complete in place	lump sum	20,900.00	20,722.80	18,190.00
28	Reinforced concrete culvert across Caseyville Ave., complete in place	lump sum	20,150.00	18,033.20	22,450.00

Mystic River Bridge Piers, Mass.

OWNER: Mystic River Bridge Authority, Boston. Mass.; Charles A. Maguire and Associates, Boston, and J. E. Greiner Co., Baltimore, Md., engrs.

PROJECT: Construction of piers S-1 and S-2 of substructure of Little Mystic Channel Span, part of the Mystic River Bridge Project, Charlestown, Mass. Work includes 1,530 cu. yds. of excavation, 920 cu. yds. of wet excavation and furnishing and driving 15,195 lin. ft. of steel H piles.

CONDITIONS: All materials are to be furnished by contractor. Access to job site is available by rail, highway and water. Stipulated contract time is 250 calendar days. Prevailing labor wage rates per hour are: iron workers, $2.00; crane operators, $2.25; pile driver operators, $2.25; cement finishers, $1.99½; truck drivers, over 1½ tons. $1.25; and common laborers, $1.40.

(*Continued on page* 101)

Mystic River Bridge Piers, Mass.

(*Continued from page 98*)

BIDS: Fourteen bids were received, ranging from the contract low of $269,869.50 to $550,192.00. Contract was awarded December 15, 1947.

LIST OF BIDDERS:

1. V. Barletta Co., Roslindale, Mass. (contract) $269,869.50
2. M & R Const. Corp., Boston, Mass 279,789.50
3. Coleman Bros. Corp., Boston, Mass 309,953.75
4. Merritt-Chapman & Scott Corp., New London, Conn. 325,175.00
5. Munroe-Langstroth, Inc., N. Attleboro, Mass. 329,747.75
6. Northern Const. Co., Inc., Lawrence, Mass. 342,727.00
7. Berke Moore Co., Inc., Boston, Mass. 383,941.00
8. T. Stuart & Son Co., Watertown, Mass. 385,922.50
9. New England Foundation Co., Inc., Boston, Mass. 391,833.00
10. J. F. Fitzgerald Const. Co., Boston, Mass. 393,310.50
11. Gahagan Const. Corp., New York, N. Y. 396,208.00
12. B. Perini & Sons, Inc., Framingham, Mass. 403,647.50
13. Spencer, White & Prentis, Inc., New York, N. Y. 447,906.50
14. Marinucci Bros. & Co., Dorchester, Mass. 550,192.00

	Item	Quantity	Unit Prices (1)	(2)	(3)
1	Facilities for resident engineer	lump sum	$6,000.00	$5,175.00	$8,000.00
2	Excavation	1,530 cy	10.00	18.00	6.00
4	Wet excavation	920 cy	20.00	20.00	8.00
5	Relocation of utilities	lump sum	500.00	1,000.00	2,000.00
6	Pile load tests	2 ea	2,000.00	1,000.00	2,000.00
7	Furnishing steel H piles	15,195 lf	3.85	3.80	4.25
8	Caps for steel H piles	249 ea	15.00	20.00	40.00
9	Splices for steel H piles	54 ea	60.00	70.00	200.00
10	Driving steel H piles	15,195 lf	2.25	1.30	3.00
11	Reinforcing steel	393,000 lb	.075	.10	.09
12	Class A base concrete	1,520 cy	16.00	20.00	22.00
13	Class A structure concrete	2,490 cy	29.00	28.00	32.00

Highway and Culvert, Grundy Co., Mo.

OWNER: Missouri State Highway Commission.

PROJECT: Grading of culverts and construction of bridge and pump house on Route E, Grundy County, east of Laredo, Missouri. Road work includes oil treatment of earth surface and is divided into two parts: the first, .982 miles long, includes laying of 420 lin. ft. of culvert pipe, and the second, 3.346 miles long, includes laying of 646 lin. ft. of culvert pipe, and removal of 171.45 ft. of hedge. The bridge is a continuous I-beam superstructure with concrete piers and floor. Pump house is a small frame building with concrete pump well.

CONDITIONS: All materials are to be furnished by contractor. Access to job site is available by both rail and highway. Stipulated contract time is 140 working days. Prevailing hourly wage rates are: skilled labor, $.80; semi-skilled labor, $.50; and common labor, $.40.

BIDS: Two bids were received, the contract low of $112,648.90 and $117,766.90. Contract was awarded December 11, 1947.

LIST OF BIDDERS:

1. Atkinson-Windle Co., Chillicothe, Mo. (contract) $112,648.90
2. L. W. Riney Const. Co., Hannibal, Mo 117,766.90

	Item	Quantity	Unit Prices (1)	(2)
	Road Work			
1-D	Class A excavation	15,975 cy	$0.45	$0.50
1-I	Class 3 excavaton for structures	186 cy	3.00	3.00
1-O	Machine grading	5.0 sta	30.00	30.00
4A-A	Oil for treatment of earth roads (SC-2 liquid asph. material)	10,660 gal	0.13	0.14
16-B	Class B concrete (box culverts)	22.7 cy	45.00	60.00
18	Culvert pipe—12"	20 lf	2.25	2.40
18	Culvert pipe—15"	76 lf	2.50	2.65
18	Culvert pipe—18"	246 lf	3.00	2.85
18	Culvert pipe—24"	38 lf	4.00	3.90
18	Culvert pipe—30"	40 lf	5.00	5.00
19-A	Reinforcing Steel	1,870 lb	0.10	0.10
22-B	Creosoted timber piles in place	210 lf	3.50	4.00
30-B	Creosoted timber	7,050 f bm	0.40	0.60
33-A	Removal of existing structure	lump sum	100.00	350.00
	Bridge Work			
1-G	Class 1 excavation for structures	133 cy	12.00	10.00
1-H	Class 2 excavation for structures	218 cy	32.00	28.00
16-B	Class B concrete (superstructure)	141.0 cy	55.00	50.00
16-B	Class B concrete (substructure)	173.7 cy	60.00	68.00
17-B	Fabricated structural steel (substructure)	400 lb	0.40	0.50
17-B	Fabricated structural steel (I-beam spans)	157,200 lb	0.135	0.125
17-C	Steel castings	6,460 lb	0.70	0.75
22-A	Reinforcing steel	39,400 lb	0.10	0.10
22-B	Creosoted timber piles in place	309 lf	3.50	4.00
22-BI	Creo. timber pile cut-offs (at 50% of item 22-B)	45 lf	1.75	2.00
22-D	Steel piles in place	195 lf	10.00	10.00
22-D1	Steel pile cut-offs (at 50% of item 22-D)	15 lf	5.00	5.00
23-M	Grouted riprap	60 cy	20.00	25.00
30-BB	Creosoted timber	5,420 f bm	0.50	0.60
33-B	Removal of existing structure	lump sum	250.00	300.00
	Pump Well and Pump House			
1-G	Class 1 Excavation for structures	56 cy	12.00	8.00
1-H	Class 2 excavation for structures	79 cy	32.00	28.00
16-B	Class B concrete	39.1 cy	65.00	75.00
19-A	Reinforcing steel	3,550 lb	0.12	0.10
61-A	Pump house	lump sum	850.00	850.00
	Road Work			
1-C	Hedge removal	171.45 f	20.00	20.00
1-D	Class A excavation	15,293 cy	0.40	0.50
1-I	Class 3 excavation for structures	572 cy	3.00	3.00
1-O	Machine grading	91.5 sta	30.00	30.00
4A-A	Oil for treat. of earth roads (SC-2 liq. asphalt mat.)	36,430 gal	0.13	0.14
16-B	Class B concrete (box culverts)	99.4 cy	45.00	50.00
18	Culvert pipe—15"	294 lf	2.50	2.65
18	Culvert pipe—18"	324 lf	3.00	2.85
18	Culvert pipe—36"	28 lf	8.00	7.00
19-A	Reinforcing steel	10,750 lb	0.10	0.10

Road Bridge and Approaches, Ga.

OWNER: Fulton County, Ga.; Mr. L. R. Epperson, Director, Public Works Department, engineer.

PROJECT: Construction of a reinforced concrete and steel bridge on Howell Mill Road over Peachtree Creek, Atlanta, Ga. The bridge, which measures 220 ft. in length, consists of a concrete deck on steel I-beams, 7-in. concrete approaches measuring 1,365 ft., a 36-ft. roadway and two 5-ft. sidewalks.

CONDITIONS: All materials are to be furnished by contractor. Access to job site is available by both rail and highway. Stipulated contract time is 175 working days. Prevailing hourly wage rates are: skilled labor, $2.00; semi-skilled labor, $.80; and common labor, $.75.

BIDS: Eight bids were received, ranging from the contract low of $112,997.63 to $139,936.43. Contract was awarded January 23, 1948.

LIST OF BIDDERS:

1. R. T. Smith, Atlanta, Ga. (contract) $112,997.63
2. MacDougald Const. Co., Atlanta, Ga. 119,034.59
3. Stewart Bros., Atlanta, Ga. 126,454.12
4. Henry Newton Co., Decatur, Ga. 127,193.86
5. W. L. Cobb Const. Co., Decatur, Ga. 129,364.37
6. S. B. Slack, Decatur, Ga. 132,290.30
7. W. J. Tidwell, Jr., Douglasville, Ga. 132,483.62
8. G. L. Strickler, Austell, Ga. 139,936.43

	Item	Quantity	Unit Prices (1)	(2)	(3)
	Bridge				
1	Clearing & Grubbing	lump sum	$50.00	$125.00	$200.00
2	Class A Concrete	988.71 cy	47.50	48.50	47.50
3	Reinforcing Steel	128,790 lb	0.085	0.09	0.09
4	Structural Steel	lump sum	23,500.00	20,500.00	19,000.00
5	Excavation No. 1	2,165 cy	2.25	4.00	10.00
6	Hand Railing	440 lf	4.50	4.50	5.00
7	Unclassified Excav.	1,200 cy	0.50	0.42	0.50
8	Setting Gas Line Supports	lump sum	160.00	30.00	50.00
	Approaches				
9	Clearing & Grubbing	lump sum	150.00	200.00	250.00
10	Add. Clearing & Grubbing	3 ac	50.00	125.00	100.00
11	Unclass. Excavation	8,136 cy	0.40	0.45	0.45
12	Paving Removed	4,736 sy	0.50	0.50	0.40
13	Adjust Manholes	1 ea	10.00	25.00	10.00
14	24" C. D. Pipe	84 lf	3.70	4.35	3.50
15	30" C. D. & Long. Pipe	144 lf	5.00	6.50	4.50
16	30" C. M. Pipe	109 lf	5.00	6.00	4.00
17	Brick Catch Basins	6 ea	140.00	150.00	100.00
18	Add. "H" Catch Basins	9 lf	20.00	20.00	20.00
19	Cl. B Conc. Still. Basins	2 ea	150.00	235.00	150.00
20	7" Concrete Paving	3,826 sy	3.50	4.10	3.35
21	Integral Curb	2,253 lf	0.50	0.50	1.00
22	Finishing & Dressing	2,306 sy	0.05	0.04	0.05
23	Grassing	4,306 sy	0.05	0.06	0.05
24	Excav. for Culverts & Str.	225 cy	1.00	1.75	1.00

In this unusual new Sewage Disposal Plant 5 services are Byers Wrought Iron

One of the finest and most unusual sewage treatment plants in the country has recently been completed at the University of Florida, Gainesville, Florida. One of its primary purposes is to permit experiments to determine the most efficient and economical type of sewage disposal, and operations are being watched with great interest by sanitary engineers.

Reynolds, Smith and Hill were the consulting engineers, and C. D. Williams, Head Professor of Civil Engineering, the resident engineer. Paul Smith Construction Company was the general contractor.

COMBATING CORROSION

Widespread use of Byers Wrought Iron pipe is standard practice in modern sewage plants and this one is no exception. The plant has two trickling filters—one standard rate, the other high rate—and in each the rotary distributors are genuine wrought iron pipe. The same material was used for the 2″ sampling lines from raw sewage influent, primary and secondary sedimentation, trickling filters, and final effluent. The 3″ gas lines from two digestor tanks to sludge heat exchanger and from sludge heat exchanger to lab, and all supernatent lines, are also Byers Wrought Iron pipe. The sampling lines run underground, so that the corrosion-protection of wrought iron is doubly important.

PROVEN PROTECTION

The almost universal use of wrought iron in present-day plants is the best certification of its excellent performance. Engineers have applied the material in practically every service in the treating plant, and have found that it stands up in applications where ordinary materials failed in a matter of months.

The reason for wrought iron's superior service is found in its unique composition and structure. Tiny fibers of glass-like silicate slag, threaded through the body of high-purity iron, halt and "detour" corrosive attack, and so discourage pitting. The fibers also anchor the initial protective scale, which shields the underlying metal.

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Our technical bulletin, "Wrought Iron for Sewage Treatment and Disposal Installations", reviews the conditions encountered in various services, and reports the results obtained with wrought iron. Would you like a copy? Just write.

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MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

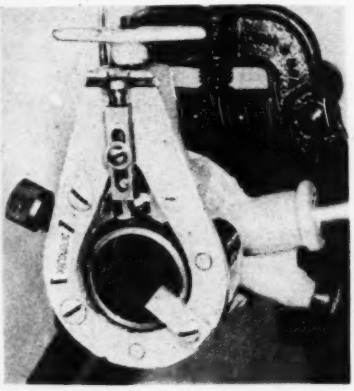
(Number refers to item directly below it)

222

ROAD PATROL — This grader includes redesigned front and rear axles providing added strength, greater clearance, increased flotation and better traction. The unit has center control for easy steering, and aircraft type hydraulic fittings. Weighing 10,500 lb. the "Welterweight", as it is called, is claimed to have the strength and power to handle practically "anything on the road." It is recommended as the major unit for all routine road maintenance. Extras include scarifier, bulldozer, V-type snow plow and cab or canopy. Leaning front wheels are available as a factory installed extra.—*Contractors Machinery Co., Batavia, N. Y.*

23

PIPE GROOVER — A new portable automatic pipe groover is said to easily and quickly convert plain end pipe so that it may be used with Victaulic couplings and fittings. Known as the "Vic-Groover" the new device may be operated either by hand or by power, and grooves pipe in half the time and requires far less effort for threading. The "Vic Groover" machine is now available in sizes to accommodate pipe sizes of from ¾ to 4 in.—*Victaulic Co. of America, 30 Rockefeller Plaza, New York 20, N. Y.*



224

IN PLACE OF TARPAULINS—A new idea in winterizing new construction is to use a celanese product in place of tarpaulin weather shields. In building its own new plant last winter the manufacturer replaced the ordinary tarpaulin with Vimlite to cover each successive course of brick and concrete construction work. Without shutting out daylight the product produced a higher inside temperature by 15 degrees, enabling the builders to handle brick, cement and concrete more efficiently than in the drafty semi-darkness of the old method. Vimlite can be used over and over again, and can be tacked or stapled to light framing to produce any desired width or length. *Celanese Corp. of America, 180 Madison Ave., New York 16, N. Y.*

225

ROTARY DRILL—Concrete Termites depend on new patented rotary pulverizing action rather than sharp cutting edges or hammer-like blows to drill straight, clean holes through any masonry-like material. Available in ⅛-in. sizes from ½ to 1½-in. dia., they can be used with any electric drill.—*Concrete Termite Sales Co., 2301 Main St., Santa Monica, Calif.*

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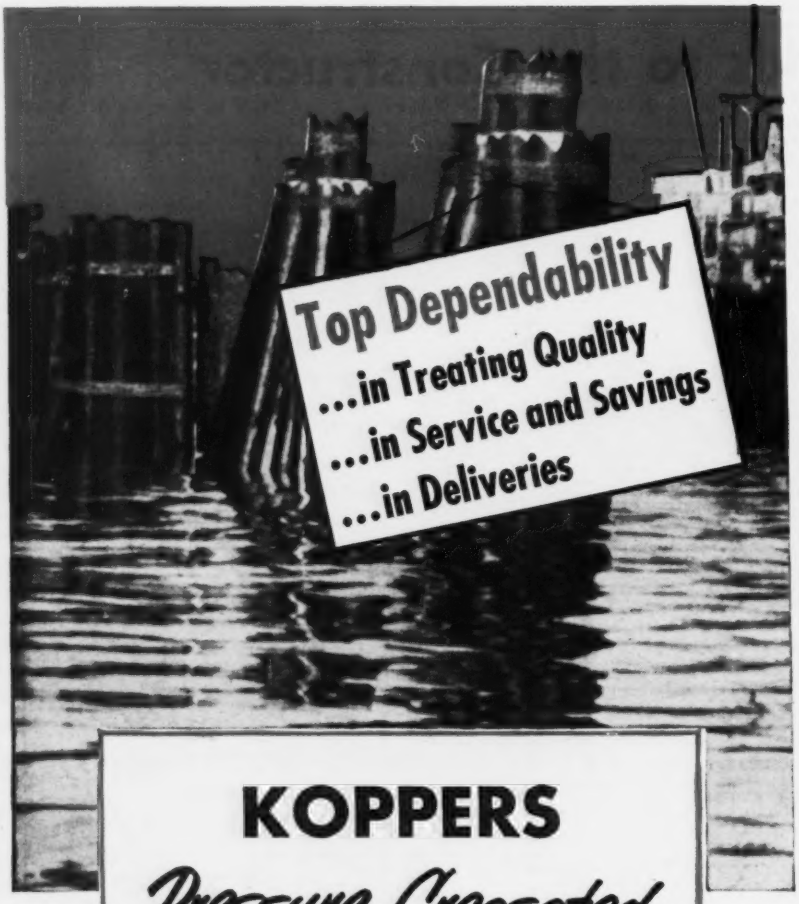

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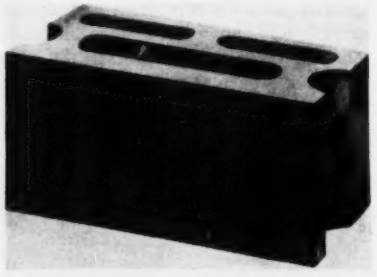
226

CONCRETE FORMS AND TIES — Bulldog forms, erected and stripped for 3.1 c. per sq. ft., feature inexpensive crimped wire form-tie (costs 1 c. for 8-in. wall) that not only spaces and holds opposing wall faces but also joins adjacent panels together without walers or strongbacks. Right-angle crimp at end of tie extends through slot in edge-bracing of panels and is wedged with ordinary cut nail to hold units together. Forms have sheet steel panel plug-welded to steel frame for square, tight, flush joints that eliminate fins on concrete wall face and thus cut finishing costs. High tensile, corrosion-resistant alloy steel forms are practically indestructible, easily handled (16 x 48-in. unit weighs 40 lb.), come in 4 to 10-ft. lengths in seven different widths from 4 to 24 in. so standard panels can form any dimension to within 1 in. Interchangeable plywood faced panels are available for mailing inserts, boxes, etc. Form are for sale or rent.—*Bulldog Concrete Forms, Inc., 100 West 42 St., New York 18, N. Y.*

227

THREE-CELL CONCRETE BLOCK —A concrete block that is described as "Redi-Furred" is a 3-cell structure designed to reduce heat loss and moisture travel through the block to such a degree that the need for plaster furring strips on the inside of the wall is eliminated. Instead of the usual cellular block structure, the new block is made



with three long air cells parallel to the long side of the block so that moisture cannot travel straight through the concrete at any point. Tests conducted by the manufacturer indicate that heat loss is 10 to 15 percent less in this type of block than in conventional blocks. Data on the design, and machine for manufacture, are now available.—*F. C. George Machine Co., 100 So. Westmoreland Drive, Orlando, Fla.*

228

HYDRAULIC PRODUCTS — New line includes hydraulic pumps, motors, valves, cylinders and compact 3-in-1 power unit which incorporates pump.

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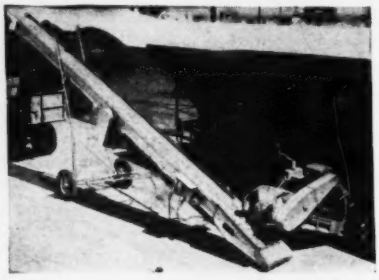
control valve and reservoir in one design. Pumps, motors and power units are available in four sizes—15, 25, 50 and 60 gpm. Cylinders are made in three sizes—4, 5 and 6 in. dia. Valves come for control of flow up to 50 and 70 gpm. Design features are interchangeable spur-type gears, needle roller bearings, positive lubrication, and bronze reversible thrust plates.—*LaPlant-Choate Mfg. Co., Inc., Cedar Rapids, Iowa*

229

HOPPER-CAR UNLOADING TEAM—Two new units for unloading bulk materials from hopper cars are: heavy-duty car unloader called the "368", which has capacity up to 3 tons per minute operating in pits or above rails, and new 363 stockpiler-loader. Conveyor of unloader has chain and belt



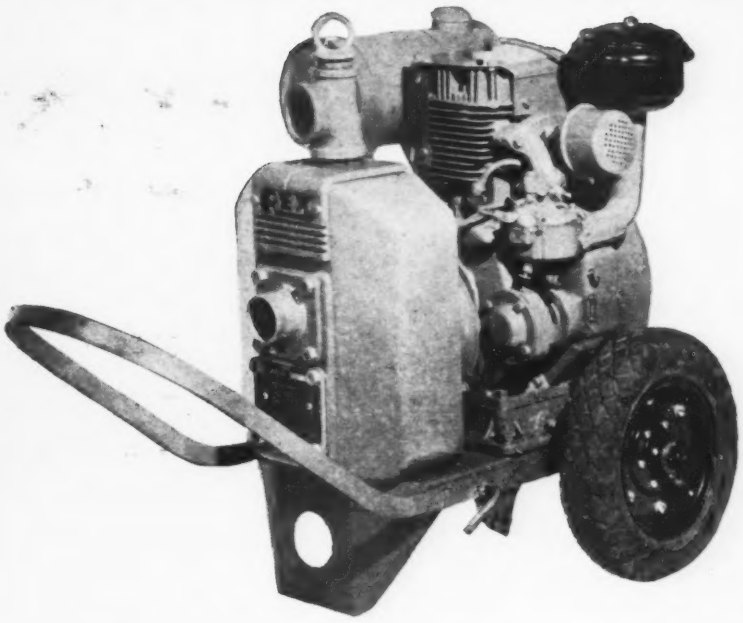
riveted together by means of steel attachments and cleats. Power is transmitted through chain and belt to give positive belt movement at all times without jam-ups. Stockpile-loader is available with 24-in. cleated or plain belt, and in 25, 30 and 35 ft. lengths.—*Barber-Greene Co., Aurora, Ill.*

230

LOW BED TRAILER — Model 6A trailer weighs 3,500 lb. and has rated capacity of 6 tons. Floor is of 2-in. oak planking. Other specifications are: length of trailer, 18 in.; length of bed, 14 in.; overall width of trailer, 96 in.;

width of bed inside, 76 in.; floor of bed, 14 in.; clearance under frame, 9 in., height of side from floor, 10 in.; side plate 3/8 in. Hitch is of welded construction with 12-in. adjustment.—*Alfred Stauffer Machine Shops, Honey Brook, Pa.*

"Easy Flow" for EASY PUMPING



DEPENDABILITY *PLUS*

A Rex "Easy Flow" Pump is dependability itself... not for just one season but for many a year of tough service. Note the rugged press-formed pump body with its glass-smooth steel interior surface. This frictionless surface permits the smoothest flow of water through the pump... increases pump efficiency. There are no rough, pitted surfaces to encourage corrosion and early wear. No priming delays with this design. And note the straight line suction intake. Water takes a slightly downhill flow right to the eye of the impeller with least possible friction loss.

SUSTAINED EFFICIENCY

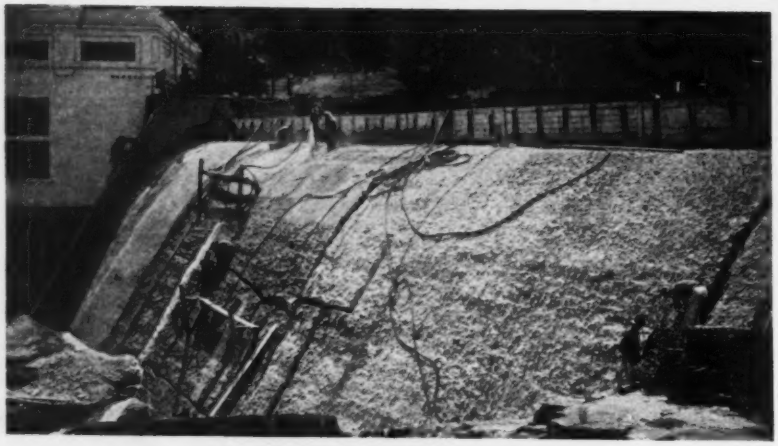
Rex "Easy Flow" has a replaceable liner plate and a lifetime seal. But, here's the real secret behind the ability of the Rex "Easy Flow" to give you new pump efficiency for the lifetime of the pump. The *exclusive* adjustable air peeler is easily adjusted to restore original clearance with the impeller to compensate for wear... assuring the ability in an old pump to give you original priming efficiency at maximum suction lifts.

LIGHT WEIGHT

With its press-formed body and volute, the Rex "Easy Flow" is approximately 30% lighter than cast styles. It's easy to handle... easy to spot. Yet this pump is the most durable in the field... proved in actual applications. Engine is located over the wheels so you lift only the weight of the pump when wheeling from spot to spot.

For all the facts, see your Rex Distributor or write for your copy of Bulletin No. 47-12. Chain Belt Company. 1633 West Bruce Street, Milwaukee 4, Wis.

CHAIN BELT COMPANY REX CONSTRUCTION MACHINERY



DAM REPAIRED WITH "GUNITE"

The photograph shows the "GUNITE" restoration work in progress on the downstream face of a badly disintegrated concrete dam belonging to the Central Hudson Gas and Electric Company near Poughkeepsie, New York.

Note the freshly chipped portion in the foreground, the "GUNITE" being applied and the completed "GUNITE" work in the background. Drainage channels were provided behind the "GUNITE" to lead seepage to the toe and thus prevent frost damage to the new "GUNITE" coating. We did this work in 1942.

Write for your free copy of our 72-page illustrated general bulletin A2300.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.

SUB-ZERO WEATHER
Didn't Stop This WISCONSIN POWERED MIXER

Illustrated here is a Model 6S-PT Gilson Mixer, manufactured by Gilson Bros. Co., Fredonia, Wis., operating in sub-zero weather. Dependable, all-weather power is supplied by a Model VE-4 (4-cylinder V-type) Wisconsin Air-Cooled Power Unit — equipped with weather-sealed outside magneto and an impulse coupling (standard equipment) which assures quick, easy starting in the coldest weather.

You never have either cold weather or hot weather cooling problems when your equipment is powered by a Wisconsin Engine—and you are assured of Most H. P. Hours of trouble-free, on-the-job service. Available in a full range of types and sizes, from 2 to 30 hp.

WISCONSIN MOTOR CORPORATION
World's Largest Builders of Heavy-Duty Air-Cooled Engines
MILWAUKEE 14, WISCONSIN

Manufacturers' Publications

231

Well Driller—A circular explains the fine points of a lightweight yet heavy duty automatic well digger. The drill weighing 125 lb. is raised and dropped by a cam approximately 36 times a minute. Actual use proves it will drill through any strata drilled by much larger machines.—*Consolidated Industries, 9 South Colony Street, Wallingford, Conn.*

232

Weldability Directory — Condensation of a U. S. and Canadian engineering survey designed to show weldability of several thousand major and minor commercial alloys, as revealed by type of weld, equipment design, and practical application of special gas and arc welding rods, has been accomplished in an 8-page, 3-color technical directory recently made available.—*Eutectic Welding Alloys Corp., 40 Worth Street, New York 13, N. Y.*

233

Kilns—Rotary kilns for cement, lime and chemical plants are described in a new 32-page illustrated bulletin issued by Allis-Chalmers. The publication shows how efficient design is vital to the economical operation of wet or dry process portland cement plants, why process industries are installing rotary kilns and how company experience and facilities serve users of such kilns.—*Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.*

234

Elevators—(12-p. booklet) Describes company's free vertical transportation engineering and planning service.—*Otis Elevator Co., 260 Eleventh Ave., New York 1, N. Y.*

235

Stainless Steel Piping—This booklet covers reasons for using stainless steel piping, types of stainless steels, standardization of pipes and fittings, selection of pipe joints, and fabrication by welding, with many tables and illustrations.—*Tube Turns, Inc., Louisville, Ky.*

236

Stream Pollution—A 4-page folder maintains that correction of stream pollution problems lies not in the complete

300 h.p. PUSHER loads up to 30 yards in less than 1 minute

WITH TODAY'S biggest team of dirtmovers, the B Tournadozer and B Tournapull, you have, for the first time, a perfect combination of BIG matched high-speed dirtmoving equipment. The new B pusher behind the B Tournapull gets big loads fast — up to 30 heaped yards in less than a minute. This dozer has speed and maneuverability to synchronize its full 300 h.p. instantly with the 225 h.p. on the Tournapull . . . it's this matched equipment that gives you accurate pushing and cutting control. Both Tournapull and Tournadozer have instantaneous gear selection without shifting . . . both have instantaneous electric controls. Both units drive on big (24.00 x 29) tires built with the new tapered beads and rayon cords to take safely, the tremendous traction developed . . . tremendous loads carried. These new type tires permit low pressure flotation for work in sand and muck. They're interchangeable — from Tournadozer to Tournapull.

You will see this B combination on a lot of the big dirtmoving projects of 1948. It follows the LeTourneau tradition — always seeking to give you better tools for increased production and lowest cost. With this new B Tournapull and B Tournadozer team we can give you a NEW and more profitable "lowest net cost per yard."

See your LeTourneau Distributor now. Ask him to show you how these "B for BIG" LeTourneau dirtmovers can improve YOUR profit possibilitiies for 1948.

Specifications

	B TOURNADOZER	B TOURNAPULL
Engine	300 hp Diesel	225 hp Diesel
Speeds		
1st gear	Fwd. and Rev. 1.6	Fwd. and Rev. 2.00
2nd gear	Fwd. and Rev. 3.3	Fwd. and Rev. 4.00
3rd gear	Fwd. and Rev. 6.8	Forward 8.00
4th gear	Fwd. and Rev. 13.6	Forward 16.00
Tires	24.00 x 29	24.00 x 29
Control	Tournatorque electric	Tournatorque electric
Transmission	Constant Mesh-Tournamatic	Constant Mesh-Tournamatic
Drive	4-wheel	2-wheel
Working Weight	25 tons	22 tons empty
Load Capacity	Blade: 5½ cu. yds. top soil	Scraper: 30 yards (35-ton load limit)

R. G. LeTOURNEAU, Inc.
Peoria Illinois

Tournapull — Trademark Reg. U.S. Pat. Off.
Tournadozer, Tournatorque, Tournamatic — Trademark

TOURNAPULLS

Another Job Showing the ADAPTABILITY of ECONOMY STEEL FORMS

An extensive system of box tunnels, with an unusual number of reverse curves, posed a difficult — and extremely expensive — forming job. Wood forming would have necessitated "tailor-making" the forms foot by foot. Economy engineers checked the job, specified various sizes of plates and provided plate-setting drawings which made possible re-use of complete sections to save time, labor and expensive material. The result: job completed on schedule.

Cost records from job after job show that when placing concrete, Economy Steel Forms consistently produce lower over-all forming costs and higher profits.

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elimination of waste and sewage, but in reducing them to enable the streams to purify themselves by oxidizing the organic matter in the waste. Equipment for domestic and industrial waste treatment is described.—*Hardinge Co., Inc., 240 Arch St., York, Pa.*

237

Soil Stabilization—A birdseye view of mixing for bituminous construction and all soil stabilization processes as well as operating techniques in other applications of interest to the highway engineer, the contractor and the landscape architect are offered in a new 23-page profusely illustrated catalogue.—*Seaman Motors, Inc., 298 North 25th St., Milwaukee 3, Wis.*

238

Aluminum Paints—How to use aluminum paints to get best results on wet walls, on wood, metal, brick, concrete (inside and outside), on heated surfaces, on roofs, on equipment, on products—which types of alluminum paint to use for specific purposes. These and other useful data on how to get maximum protection with aluminum paints is described in a new 24-page manual.—*Aluminum Industries, Inc., 2438 Beekman Street, Cincinnati 25, Ohio.*

239

Vibrex Screen—A new 4-page booklet describing a vibrex screen has been issued. Briefed for quick reading, is an explanation of the 2-bearing circle-throw principle employed in this screen, which has adjustable stroke and easy angle-adjustment. The booklet also tells how the screen, whether floor-mounted or suspended, is always in perfect balance. Applications and the full range of sizes in single or double deck styles are included.—*Robins Conveyors Division, Hewitt Robins, Inc., Passaic, N. J.*

240

Tandem Roller—An 8-page catalog describes a new 3-5 ton tandem roller with its variable weight, high maneuverability, ample power, and compaction effectiveness. The roller is said to fulfill all specification requirements for compressions ranging from 109 up to 181 lb. per inch of roll width. It can be used on small construction jobs, rolling driveways, filling station and parking lot surfaces, rebuilding and widening of old roads, and maintenance jobs of all kinds. In addition to detailed construction views and data, complete specifications are given.—*The Galion Iron Works & Mfg. Co.*

241

Aero-filter System—A 16-page bulletin describes a complete process for sewage and waste treatment, with blueprints and photographs. These basic advantages of this system are claimed: Excellent distribution; single-stage operation, producing a better plant effluent; 2-stage operations giving results comparable to activated sludge at half the cost; low construction and operating cost; uninterrupted and almost complete momentary bed coverage; and all returns made direct to the filter.—A shorter bulletin describes a streamline sludge collector, giving full details. *Yeomans Brothers Co., 1433 North Dayton St., Chicago 22, Ill.*

242

For Home Builders—A million copies of "Charlie Foster's catalog" are being mailed. It is an illustrated book of more than 50 pages containing descriptive matter concerning a large number of items for home builders, not only building materials, but also tools, equipment, and various hard-to-get items.—*Southern States Iron Roofing Co., Savannah, Ga.*

243

For Concrete Construction—A bulletin describes a uniform system of wall form construction, including inside and outside corners and filler panels prefabricated or job built.—*Universal Form Clamp Co., 1238-56 N. Kostner Ave., Chicago 51, Ill.*

244

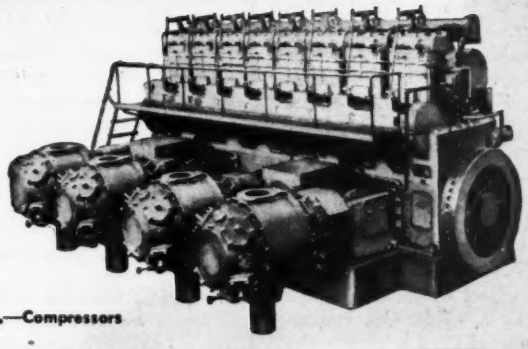
Power Cranes—A 16-page booklet contains 46 photographs illustrating different material handling jobs by both rubber tire and crawler mounted cranes, and shows the use of 15 typical attachments, including clam-shell and dragline buckets, electric magnets, hooks, slings and tongs.—*The Thew Shovel Co., 1404 Terminal Tower, Cleveland, Ohio.*

245

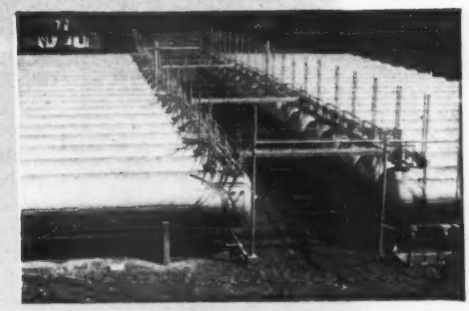
Shovels—A new bulletin, No. 64-A, describing and illustrating the LIMA Type 604 shovel, crane and dragline, gives details of construction and operating advantages, including the application of precision air control. As a shovel, the Type 604 has a capacity of 1½ cu. yd.; as a crane, 30 tons; and as a dragline, variable.—*Lima Shovel and Crane Division, Lima-Hamilton Corp., Lima, Ohio.*

FOR STORAGE—

Matched Equipment — Matchless Service



Clark Bros.—Compressors



Stacey-Dresser Engineering—L. P. Gas Plants

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INERT GAS GENERATORS	Roots-Connersville
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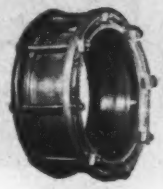
HIGH-PRESSURE STORAGE TANKS	Stacey Bros.
PROPANE AIR AND BUTANE AIR PLANTS	
L. P. GAS PLANTS	Stacey-Dresser Engineering

Stacey Bros.—Holders



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This is what Dresser Industries passes to you with the sale of any storage equipment.

The separate companies in the Dresser family are each specialists in some type of equipment. But as a group they draw upon the pooled engineering and research of the whole of Dresser Industries, Inc. That covers the gas industry from well drilling equipment to research into coal gasification and sub-zero storage, on the world's largest scale.

Dresser Industries, through its operating companies, has built the largest Liquid Petroleum Gas Plants in the world. Also, through its operating companies it manufactures a complete line of storage equipment, with *variations in types* of equipment. Therefore, you get the benefit of the broadest knowledge of the industry and salesmanship which does not have to carry the torch for any particular type of pump, holder or whatever it is you need.

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KOBE, Inc.
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PACIFIC Pumps, Inc.
Huntington Park, Calif.

PAYNE Furnace Co.
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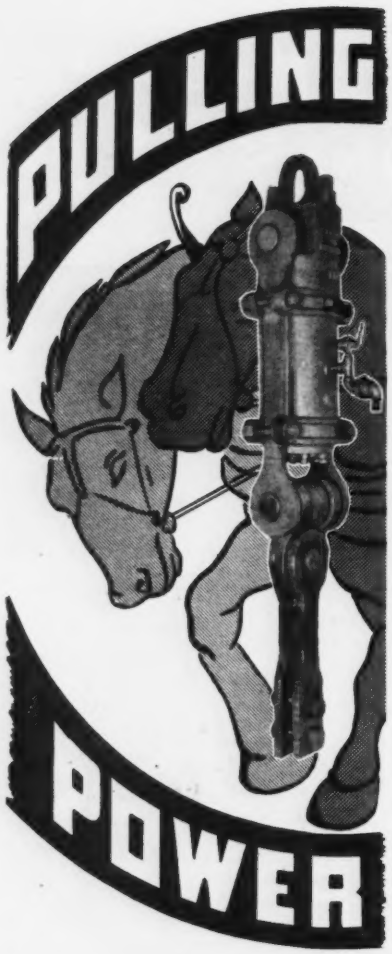
ROOTS-CONNERSVILLE Blower Corp.
Connersville, Ind.

SECURITY Engineering Co., Inc.
Whittier, Calif.

STACEY BROS. Gas Construction Company
Cincinnati, Ohio

Stacey-Dresser Engineering Division
Cleveland, Ohio



VULCAN

PILE EXTRACTORS

• Power is harnessed in the Vulcan Pile Extractor for just one purpose: pulling piles under the toughest conditions. That's specialized power which means maximum efficiency and speed on the job every minute, saving time and reducing costs.

This Vulcan Pile Extractor is simple in construction as it is effective and durable. With only one moving part it requires no assembly to put it in service, no adjustments, and it can't get out of order.

Designed for pulling sheet steel, wood, concrete H-beam and pipe piles, this compact, inexpensive machine comes in three sizes to handle any kind of pile extracting job. Write today for complete details.

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Elections and Activities

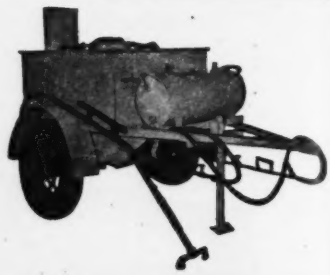
Wayne Sutton of the Washington Asphalt Co., Seattle, Wash., has taken office as president of the Mountain-Pacific chapter of the Associated General Contractors, with Paul Jarvis of Paul Jarvis, Inc., vice-president and W. J. Pierce of Osberg Construction Co. treasurer. Trustees are Paul Fiorito, N. Fiorito Co.; Elmer J. White, MacRae Bros.; C. R. Wilcox, Western Asphalt; J. F. Beardsley, General Construction Co.; Paul G. Ellis, Graysport Construction Co., Aberdeen; Gil Griffin, Morrison-Knudsen Co., Inc.; Don L. Cooney, Don L. Cooney, Inc.; Ivan Bruensbach, Peter Kiewit Sons Co., Longview; J. W. Hardison, J. W. Hardison Co., Yakima; T. H. Youell, Diesel Oil Sales Co., and C. V. Wilder, C. V. Wilder Co., Bellingham. J. A. Denn of the Pacific Powder Co. was named associate trustee.

The Kittitas County Associated General Contractors of Ellensburg, Wash., has elected Harold Corey of the Gaasland Construction Co., president, George Jones, vice-president and Don Heavilin, secretary-treasurer.

The North Carolina Section of American Society of Engineers has elected following officers: Herman C. Baity, Chapel Hill, N. C., president; John D. Watson, Greensboro, N. C., first vice-president; and B. W. Davis, Raleigh, N. C. second vice-president.

James Logan has been elected president of the New Jersey Society of Professional Engineers. The publication of a minimum salary and fees schedule affecting every professional engineer in the state was announced. It sets up the society's recommendations for the economic return to professional engineers in government, industry, business, and private practice. Other officers are first vice-president, Hugh C. Clarke, Jersey City; second vice-president, Louis T. Klauder, Moorestown; secretary-treasurer, Merton S. Adams, Trenton; national directors, C. George Krueger, Jersey City; Leo K. McKee, Red Bank; Frank C. Mirgain, Highland Park; Earl L. Daily, Woodbury; first trustee-at-large, John C. Remington, Camden; second trustee-at-large, Amos F. Dixon, Stillwater.

V. N. Holderman, of V. N. Holderman & Sons Co., Columbus, has been elected president of the Ohio Contractors Association for 1948. W. E. Ringwald, Jr., of W. H. Ringwald & Sons



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Co., Chillicothe, was elected vice-president. Charles E. McKee, Columbus, is secretary-treasurer.

Bruce Short, Indianapolis, Ind., has been elected president of the Indiana Highway Material & Equipment Association, succeeding E. W. MacAllister, Indianapolis. Other new officers are Glenn P. Holcomb, Indianapolis, vice-president; E. B. Flesch, Indianapolis, treasurer, and Tom Goby, Bloomington, secretary.

Frank W. Edwards, professor of civil engineering at the Carnegie Institute of Technology, has been elected secretary and a member of the board of directors of the Pittsburgh section of the American Society of Civil Engineers.

Earl E. Cooper, chief engineer and general superintendent of the Chambers-Bering-Quinlan Co., Decatur, Ill., has been elected president of the Illinois Society of Professional Engineers.

Dan Mooney of Butte has been elected president of the Montana Contractors Association, a chapter of the A. G. C. He succeeds L. M. Sheridan, also of Butte. The Montana Building Association, a unit of the A. G. C., has elected Floyd Pappin of Great Falls as president, succeeding D. A. McKinnon of Helena.

Carolina Road Builders Association has elected these new officers: J. W. Thompson, president, Greenville, S. C. C. P. Ballenger, Jr., vice-president, Greenville, S. C., Governors: J. P. McGuire, Durham, N. C., N. K. Dickerson, Jr., Monroe, N. C.; Reubin Arthur, Greensboro, N. C.; Roy E. Geise, Columbia, S. C.; W. W. Wanamaker, Orangeburg, S. C.; and Pres Darby, Columbia, S. C.

Ohio County Engineers Association has elected A. S. Porter, Cleveland, president, John Stough, Findlay, vice president; Delos Nisson, Port Clinton, treasurer; and Walter Jacobs, Toledo, secretary. District directors are: Leroy C. Roush, Sandusky; Wilbur D. Terry, Huron; Arthur F. Ranney, Summit; Kenneth H. Kinkley, Coshocton; Warren H. Veatch, Knox; A. J. Moon, Wyandot; B. F. Sheppard, Preble; Frank Thatcher, Clinton; Carson Barklow, Scioto; and Cecil W. Stacey, Washington.

The Madison County chapter of the Illinois Society of Professional Engineers has elected the following officers: E. J. Wade, president; Kline Grigsby, vice-president; J. D. Voorhees, secretary-treasurer; and C. F. Abraham, chapter representative.

FOR FAST AND LOW COST
ACCURATE KNOWLEDGE
OF
BEDROCK CONDITIONS

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HYDRAULIC
TESTING
DRILL

When you drill to bedrock you want to know your subsurface conditions — but at LOW COST. Here is the rig that you can transport and set up easily and economically in rough country, with a couple of men if necessary. Designed especially for this class of work. Extensively used by U. S. and State Governments and many others. Extremely strong and simple.

Easy to transport, set up, take down
JUST THE DRILL FOR ROUGH COUNTRY

Outfit weighs only a total of 800 lbs. for 50 ft. drilling depths. Gives accurate samples of materials drilled. Every part can be handled by one or two men.

Send for descriptive circular giving complete specifications. It will help if you advise us regarding drilling depths and general nature of work. →

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NEW CHEVROLET ADVANCE-DESIGN '48 TRUCKS ARE LOWEST IN PRICE!

and have *all* these new and finer features

Here are the *newest* trucks—the *latest* and the *greatest* features—the *biggest* values—with the *lowest prices* in the volume field! Model for model, and with comparable equipment and specifications, Chevrolet Trucks *list for less* than competitive makes—some models *as much as $150!* Here is Advance-Design that provides the cab that "breathes,"* Flexi-Mounted Cab, Uniweld all-steel cab construction, fully adjustable seat, all-round visibility with rear-corner windows,* extra-durable frames, specially designed brakes, and many other features that put Chevrolet trucks far ahead of the field. See them at your Chevrolet dealer's.

CHEVROLET MOTOR DIVISION, GENERAL MOTORS CORPORATION
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*Fresh air heating and ventilating system and rear corner windows optional at extra cost.

NEW CHEVROLET 4-SPEED SYNCHRO-MESH TRUCK TRANSMISSION

This Chevrolet-developed Synchro-Mesh transmission in heavy-duty models provides new ease and efficiency.

NEW CHEVROLET ADVANCE-DESIGN GEARSHIFT CONTROL

Steering-column gear shift (on models having 3-speed transmission) gives new freedom to the driver, leaves cab floor unobstructed.

NEW FOOT-OPERATED PARKING BRAKE

Chevrolet's foot-operated parking brake (on models with 3-speed transmission) provides new clear floor area.

NEW IMPROVED CHEVROLET VALVE-IN-HEAD ENGINE

The world's most economical engine for its size. Has greater durability and operating efficiency.

NEW MULTIPLE-FEATURE DEVELOPMENTS

New splined rear-axle shaft attachment to wheel hubs in heavy-duty models.... Heavier springs . . . New propeller shaft bearing-support and seal design.

Manufacturers' Activities

Current developments among manufacturers relating to expansion of services, shifts in personnel, and other changes, include the following:

Home Office Changes—M. M. Yarrington has been named general manager and Fred C. Wittig assistant general manager of AEROIL PRODUCTS CO., West New York, N. J. . . . Ralph H. Wise has been made director of engineering of LUSTRON CORP., Columbus, Ohio. . . . Boyd Allen is now staff manager of customer relations of the building products division of the JOHNS-MANVILLE CORP., New York City.

Sales Staff Changes—H. F. Groendyk is director of product sales for MANHATTAN RUBBER division of RAYBESTOS-MANHATTAN, INC., Passaic, N. J. . . . Joseph P. Kleinkart has been made general sales manager of the RAMAPO AJAX division of AMERICAN BRAKE SHOE CO., New York City . . . J. R. Hildinger has been appointed sales representative at the main office and factory of MARION POWER SHOVEL CO., Marion, Ohio, and J. K. Dolan in the Chicago office . . . Andrew J. Lacock has been appointed district manager of sales of LUKENS STEEL CO. and divisions at 50 Church St., New York 7, N. Y. . . . Carl P. Simmons has been made service engineer of the Philadelphia, Pa., territory for the NELSON SALES CORP., Lorain, Ohio . . . D. D. Hamilton is to head the building materials section of the KOPPERS CO., INC., Pittsburgh, Pa. . . . Rene Dansereau is sales engineer of the Carter division of the DOMINION BRIDGE CO. at Lachine, Que, and MacKenzie MacMurray will be attached to the company's Ontario division at Toronto . . . S. M. Walton has been appointed as industry manager to be in charge of sales of a new all aluminum utility building for the ALUMI-DROME division of the REYNOLDS METALS CO., Louisville, Ky. . . . New sales appointments at the TYSON BEARING CORP., Massillon, Ohio, are: George C. McMullen, vice-president in charge of sales; W. H. Oexle, general sales manager; H. J. Deal, midwest territory, Chicago; Ivan C. Mann, assistant sales manager; R. R. Flaisig, southern Ohio; . . . Stuart W. Goodenough has been made assistant Chicago manager of the manufacturers products sales department of AMERICAN STEEL AND WIRE CO. . . . W. E. Simons has been appointed general sales manager of THE HEIL CO., Milwaukee, Wis., and Harvey N. Pugh

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Decay like this means added maintenance costs, and may affect safety. Prevent such decay by the use of Pentachlorophenol treated wood when building or repairing. Tested under the most adverse conditions, Pentachlorophenol has proved itself a lasting, effective protection against both decay and termites. It is applied at low concentrations in petroleum oils by established pressure and nonpressure treating methods—a scientific wood treatment that offers measured toxicity. Pentachlorophenol treated wood is clean, easy to handle, and paintable if the proper solvent is used.

You will want to specify Pentachlorophenol treated wood. It's a sound investment that pays dividends in reduced maintenance. A list of treating plants is available on request.

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Short stadia lines, spaced and ruled at precise intervals on optically flat glass, are easy to sight...do not extend over entire field of view nor interfere with cross-lines. Send for Bulletin No. 50. W. & L. E. Gurley, Union Plaza, Troy, New York.

Available only in Gurley Instruments

Stadia lines spaced 1:100 horizontally and vertically with a circle 15' 45" radius for centering the sun's image... one of several new Gurley Reticle patterns.

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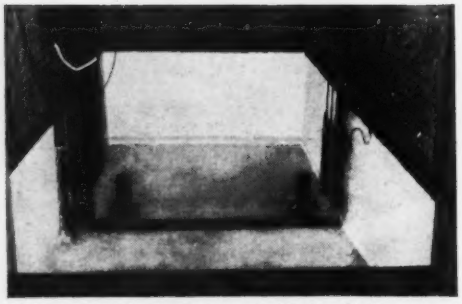
4-FT. TIDE in Elevator Pit HELD BACK by AQUELLA

The Barnum Garage, Bridgeport, Conn., is located directly over an old river bed. For years, when the tide came in, the pit filled with 4 feet of water, rusting cables and causing frequent breakdowns. Aquella was applied in 1945. Since then, though surrounded by water, walls and floor of the pit have remained thoroughly dry.



Elevator pit, following treatment with Aquella 3 years ago.

Theatre, Sacramento, Cal., and radio station, Memphis, Tenn., showing beautiful white Aquella finish. Damp, unsightly home (below) now bright and dry after Aquellizing.

Over and over Aquella does "the impossible." Working on entirely new principle, this amazing mineral surface coating controls seepage above or below grade, interiors or exteriors.

Use Aquella for all porous masonry surfaces—brick, concrete, stucco, stone, cement, cement plaster, masonry units. Comes in brilliant white, also buff, rose, green, gray.

Cross section showing how Aquella *penetrates* tiniest pores, then *expands*. Continues to harden with age. Will not crack, peel or rub off.

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PRIMA PRODUCTS, INC.
Dept. J, 10 E. 40th St., New York 17, N.Y.

Please rush FREE 16-page booklet, "Aquella and Concrete Masonry Construction."

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SEE OUR CATALOG IN SWEET'S

← New brochure shows how architects, engineers, contractors use Aquella to control water seepage in all porous masonry. Send coupon

is vice-president in charge of sales and advertising . . . Charles R. Sorber, Jr., has been made district sales representative for the special chemical division of the PENNSYLVANIA SALT MFG. CO. . . . John J. Risko has been made assistant sales manager of the HENDRICK MFG. CO., Carbondale, Pa. . . . Francis McNamara has been appointed eastern division sales district representative for CATERPILLER TRACTOR CO. to contact distributors in Massachusetts, Maine, Rhode Island, the Maritime Provinces and Newfoundland . . . O. B. Wilson has been named industrial manager for the eastern sales region of the BROWN INSTRUMENT division of MINNEAPOLIS-HONEYWELL REGULATOR CO. . . . William Lee has been made district manager of its new Houston, Tex., sales office of the H. K. PORTER CO., INC., of Pittsburgh, Pa.

Dealer Appointments — HAMILTON STEEL CO., 12,875 Taft Road, Cleveland, Ohio, and ARTHUR C. HARVEY CO., Boston, Mass., have been appointed distributors of its aluminum mill products by the REYNOLDS METALS CO. . . . SOUTHERN STATES IRON ROOFING CO. has gone out of the mail order and retail business, and Everwear Aluminum roofing, paint and all other products will be sold through dealers only . . . PENN CENTRAL EQUIPMENT CO., Altoona, Pa., has been made a distributor for the HEWITT RUBBER divisions industrial hose, conveyor and transmission belting and packing . . . CHAVIGNY CO., Houston, Tex., is sales agent for Hardinge pulp and paper, waterworks and sewage equipment in southern Texas.

Personalities — Paul Fahrney, formerly president of AMERICAN BITMULS CO., is now vice-president of the parent company, STANDARD OIL OF CALIFORNIA, C. W. Stewart has been made president of AMERICAN BITMULS; L. P. Street is general sales manager and J. H. Fenton is district manager at Baltimore, Md. . . . A. M. Davis of Lansing, Mich., has been appointed manager of the midwestern offices of the PORTLAND CEMENT ASSOCIATION of Chicago. J. Gardner Martin of Detroit, Mich., will succeed Mr. Davis at Lansing as district engineer . . . Robert A. Lawson has been made assistant division manager of the Findlay division of GAR WOOD INDUSTRIES INC., at Findlay, Ohio . . . David C. Affleck has been promoted to assistant chief engineer of the GARY STEEL WORKS, U. S. STEEL CORP. . . . L. M. Cassidy, vice-president for sales of JOHNS-MANVILLE CO., has been elected chairman of the board of governors of the ASPHALT ROOF INDUSTRY BUREAU. P. C. Rowe, executive vice-president of the FLINTKOTE CO. was named vice-chairman . . . Carl D. Franks has been elected vice-presi-

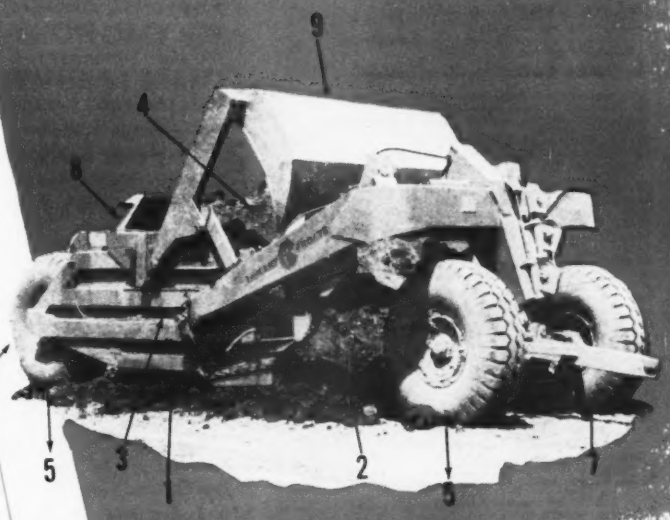
Check your present scraper against these modern LaPLANT-CHOATE *features*

SCRAPER EVALUATION CHART

Features which affect production ability—loadability—haulability—stability—of scrapers.

		Points	LPC Scraper	Your Scraper
1.	a. Curved Bowl Bottom	10	10	
	b. Flat Bowl Bottom	5		
2.	a. Offset Cutting Edge	10	10	
	b. Straight Cutting Edge	5		
3.	a. Low Center of Gravity	10	10	
	b. High Center of Gravity	5		
4.	a. Open Top Bowl	10	10	
	b. Obstructed Bowl Top	5		
5.	a. Weight Distribution 45% front 55% rear	10	10	
	b. Weight Distribution Otherwise	5		
	Weight empty			
	a. Under 5% variation	10	10	
*6.	b. 5% to 15% variation	6		
	c. Over 15% variation	2		
7.	a. Interchangeable Tires—Front & Rear	10	10	
	b. Non-interchangeable Tires	5		
8.	a. Positive Forced Ejection	10	10	
	b. Gravity Dump	7		
	a. High Apron Lift	2		
**9.	b. Medium Apron Lift			
	c. Low Apron Lift			
	General Maintenance & Serviceability Characteristics	10	10	
10.	a. Superior	6		
	b. Average	2		
	c. Inferior			
	Total	100		

Capacity Struck Yards	*Average Weight 8 Manufacturers	High	**Height of Apron Lift Medium	Low
12—15	21,950	100" & up	70" — 100"	Under 70"
7—9	15,143	90" & up	60" — 90"	Under 60"
5—7	11,020	80" & up	50" — 80"	Under 50"



BETTER ROADS FOR A BETTER WORLD — 45th Annual Convention and Road Show — SOLDIER FIELD CHICAGO — JULY 30-31, 1945

Here's an easy way to see if you are getting all possible profit from your earthmoving jobs. Maybe you're losing money with obsolete equipment using a good tractor to haul ten yards when it can handle fourteen.

Modernize now with LaPlant-Choate scrapers! Their profit-earning capacity is unmatched! They get bigger loads faster and easier in all kinds of material. They will carry a smooth, even spread in high gear. Savings in tractor and scraper maintenance also add to your profit. Your nearest LPC distributor can give you complete details. Ask for Bulletin A-1143-A. LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa; 1022 77th Ave., Oakland, California.

LaPLANT-CHOATE

HIGH SPEED EARTHMOVING EQUIPMENT

FOR LOWEST POSSIBLE COST PER YARD...PER JOB...PER YEAR

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See ad on page 127 for list of equipment in each line

Worthington-Ransome Distributors

Ala., Birmingham, Ragsdale Mach. Co., Inc.
Alaska, Anchorage, Airport Mach. & Storage Co.
Ariz., Phoenix, Lee Redman Equipment Co.
Ark., Fort Smith, R. A. Young & Son
Little Rock, R. A. Young & Son

Calif., Richmond, Bay Equip. Co.
Cal., L. A. Golden State Equip. Co.
Colo., Denver, Power Equipment Co.
Conn., Wallingford, Wilhelm-Davies Co., Inc.

Fla., Miami, Allied Equip. Inc.

Jacksonville, Ogden Equip. Co.
Orlando, Highway Equipment and Supply Co.
Tampa, Epperson & Company

Ga., Atlanta, Tractor & Machinery Company

Ida., Boise, Olson Manufacturing Co.
Ill., Chicago, Thomas Hoist Co.
Iowa, Cedar Rapids, McNall Mach. & Supply Corp

Kansas, Topeka, M. B. Salisbury Co.
Ky., Harlan, Crowshorn Equip. & Supply Co.
Louisville, Williams Tractor Co.

Maine, South Portland, N. A. Burkitt, Inc.
Mich., Muskegon, Lakeshore Machy. & Supply Co., Inc.
Mich., Detroit, W. H. Anderson Co., Inc.
Minn., Minneapolis, Phillippi Murphy Equip. Co.
Mass., Cambridge, Field Machy. Co.
Mass., West Springfield, K. F. Edson Co., Inc.
Miss., Jackson, Jackson Road Equip. Co.
Md., Baltimore, Paving Supply & Equip. Co.
Md., Salisbury, Paving Supply & Equip. Co.
Mo., Clayton, The Howard Corporation
Mo., Kansas City, Machinery & Supplies Co., Inc.
Montana, Billings, Interstate Truck & Equip. Co.
Helena, Caird Eng. Works
Montana, Missoula, Miller Machinery Co.

Nevada, Elko, C. W. Paul Hardware and Machy. Co.
N. Hampshire, Manchester, R. C. Hazelton Co., Inc.
N. J., No. Bergen, American Air Comp. Corp.
N. M., Roswell, Smith Machy. Co.
N. Y., Albany, Milton Hale Machinery Co.
N. Y., Buffalo, Murray Equip. Co.
New York, Hodge & Hammond, Inc.
Syracuse, Milton-Hale Mach. Co.
N. C., High Point, Smith Equip. Co.
N. D., Fargo, Smith, Inc.

Ohio, Cincinnati, Carroll-Edwards & Co.
Dayton, Carroll-Edwards & Co.
Toledo, The Kilcorse Machy. Co.
Okla., Oklahoma City, Tartan-Douglas Equip. Co
Oregon, Portland, Anderson Machinery

Pa., Bradford, Bradford Supply Co.
Wilkes-Barre, Lavelinger & Co.
Mechanicsburg, American Equip. Corp.
Philadelphia, Metalweld, Inc.

S. C., Columbia, Smith Equipment Co.

Tenn., Chattanooga, Dempster Bros., Inc.
Tenn., Knoxville, Dempster Bros., Inc.
Memphis, Hamilton Tractor Co.
Nashville, Dempster Bros., Inc.
Tex., Amarillo, T. W. Carpenter Equip. Co
Abilene, W. T. McClure Mach. Co.
Dallas, Shaw Equip. Co.
Houston, So. Texas Equip. Co., Inc
San Antonio, San Antonio Machy. & Supply Co.

Utah, Salt Lake City, J. K. Wheeler Mach. Co.

Vt., Barre, A. M. Flanders, Inc.
Va., Richmond, Highway Machy. and Supply Co.
W. Va., South Charleston, Allied Equip. Co.
Wash., D. C., Paving Supply & Equip. Co.
Wash., Seattle, Star Machy. Co.
Wash., Spokane, Star Machy. Co.
Wash., Yakima, Star Machy. Co.
Wisc., Milwaukee, Drott Tractor Co., Inc.

Ransome Distributors

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N. Y., Rochester, B-G Equip. Co.

O., Cleveland, H. B. Fuller Equip. Co.

Pa., Pittsburgh, Arrow Supply Company.

Worthington Distributors

Ind., Indianapolis, Reid-Holcomb Company

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Md., Baltimore, D. C. Elphinstone, Inc.

O., Cleveland, Gibson-Stewart Co.
O., Columbus, Gibson-Stewart Co.

Pa., Allentown, H. N. Crowder, Jr., Inc.
Pittsburgh, Atlas Equip. Corp.

Texas, El Paso, Equip Supply Co.
Wyoming, Cheyenne, Wilson Equip. & Supply Co.

Buy Blue Brutes

Worthington Pump and Machinery Corp
Worthington-Ransome Construction Equipment Division
Holyoke, Massachusetts

dent for promotion of the PORTLAND CEMENT ASSOCIATION Chicago . . . Roger W. Batchelder has been made assistant to the president of the NATIONAL BEARING DIVISION of the AMERICAN BRAKE SHOE Co. and Wm. H. Old general purchasing agent.

Deceased—Alva W. Newby, 70, president of the HUBER MFG. Co., Marion, Ohio, Feb. 17, at Columbus, Ohio . . . Albert C. Burch, 59, manager of the market research department, THEW SHOVEL Co., March 13, at Sandusky, Ohio . . . L. W. Smith, sales manager for the SISALKRAFT Co., Feb. 16, at Chicago . . . Kenneth N. Cook, assistant sales manager, ROLLWAY BEARING Co., INC., March 5, at Syracuse, N. Y. . . . Hugh Buxton Lyall, vice-president and general manager of the MANITOBA BRIDGE and IRON WORKS LTD., March 12, at Winnipeg, Man. . . . Ralph E. Conder, advertising manager of the BOSTON WOVEN HOSE and RUBBER Co., Feb. 18, at Cambridge, Mass.

Miscellany—SKF INDUSTRIES, INC., announces that its branch office at Charlotte, N. C., will become a district headquarters for North and South Carolina, 74 counties in southern Virginia, 30 counties in eastern Tennessee and two in northern Georgia . . . An all-inclusive group insurance plan has been made available to all employees of the UNIVERSAL CONCRETE PIPE Co., with plants in 15 cities of eight states . . . STRUCTURAL PRODUCTS Co. has resumed production of Insulex glass blocks. A subsidiary of OWENS-ILLINOIS GLASS Co., the company was formed to operate four building material plants in Muncie, Ind., Columbus, Ohio, and in Berlin and South River, N. J. . . . FULLER MFG. Co., Kalamazoo, Mich., has brought the complete facilities of the REED FOUNDRY and MACHINE Co. of that city, providing 40,000 sq. ft. and capacity will be 15 tons of gray iron castings daily . . . HOLLAND METALS Co. division of the NEW HOLLAND, PA., MACHINE Co. has moved into its new plant at Mountville, Pa. The company makes roofing and siding and associated aluminum products . . . Ground has been broken for a large addition to the warehouse of the ALLIED STEEL PRODUCTS, INC., Cleveland, Ohio . . . Establishment of fabricating plants by dealers in major cities to furnish steel framework for multiple-unit dwellings, single homes and commercial buildings has been announced by the GREAT LAKES STEEL CORPORATION'S STRAN-STEEL division. THE CLAY SEWER PIPE ASSOCIATION has moved its Michigan office to 610 Eddy Building, Saginaw. . . . Cost list and resale price increases, are announced by the GENERAL TIRE & RUBBER Co.

Men and Jobs

R. J. Cotter, civil engineer graduate of the University of Washington, has become associated with the Concrete Products Association of Washington at Seattle in the development of all classes of concrete masonry. Before the war he was with Todd's Seattle Dry Docks, Inc., and during the war was in the Navy, serving three years of active duty as a commissioned officer.

Wayne Arrasmith has been named Whitman County engineer at Colfax, Wash., to succeed **J. H. Redmond,** who resigned because of ill health after having held the position for 13 years and having been associated with the department for 19 years. A captain of Army engineers during the war, Arrasmith has been connected with the county engineer's staff since 1939.

C. S. Sanderson, former assistant chief engineer, has been promoted to assistant general manager of the Atlantic Coast Line Railroad at Wilmington, N. C. He obtained his civil engineering degree from Mississippi State College and joined the railroad in 1923 as a rodman, subsequently holding various engineering positions with the company and its affiliate, the Charleston and Western Carolina Railway, of which he was assistant superintendent. During the war he was a lieutenant colonel in the Army, serving 34 months overseas, and later was appointed principal assistant engineer of the railroad and promoted to assistant chief engineer in March, 1947.

Lester Ashton is Union Pacific project engineer on the second Aspen, Wyo., tunnel, a 6,700-ft., $8,000,000 project to make the railway's Omaha - Salt Lake City trainway completely double-tracked. The tunnel is at an elevation of 7,200 ft. and passes under a 7,660-ft. spur of Uintah mountains. A veteran railroadman, Ashton has done construction work for UP throughout the West.

Reports and Pamphlets

(*Continued from page 96*)

SYMPOSIUM ON PAINT AND PAINT MATERIALS (1947)—Special Technical Publication No. 75, American Society for Testing Materials, Philadelphia, Pa. $2.

POWER SUPPLY IN SWEDEN—Swedish Water Power Association, 16 Norrlandsgatan, Stockholm 7, Sweden.

DIESEL FUEL OILS—The American Society of Mechanical Engineers, 29 West 39th St., N. Y. 18.

GUIDE FOR HOTEL FIRE SAFETY LAW: 1948—National Fire Protection Association, Boston 10, Mass. 50c.

THE EFFECT OF ECCENTRIC LOADING, PROTECTIVE SHELLS, SLENDERNESS RATIOS, AND OTHER VARIABLES IN REINFORCED CONCRETE COLUMNS—Engineering Experiment Station, Bulletin Series No. 368. The University of Illinois, Urbana. $1.

APPRENTICESHIP CREDIT FOR PREVIOUS EXPERIENCE—Apprentice-Training Service, U. S. Department of Labor, Washington 25, D. C.

THE DEVELOPMENT AND CONTROL OF THE MISSOURI RIVER—Corps of Engineers, Missouri River Division, Omaha, Neb.

HOUSING IN THE NETHERLANDS—By Ministry of Reconstruction and Housing, The Hague, Holland.

STANDARD RULES FOR FIELD WELDING OF STEEL STORAGE TANKS—American Welding Society, 33 West 39th St., N. Y. 18. 50c.

ARGENTINA AS A PRESENT AND POTENTIAL MARKET FOR ROAD BUILDING MACHINERY AND ALLIED EQUIPMENT AND PARTS and VENEZUELA AS A PRESENT AND POTENTIAL MARKET FOR ROAD BUILDING MACHINERY AND ALLIED EQUIPMENT AND PARTS—American Road Builders' Association, 1319 F. Street, N. W., Washington, D. C.

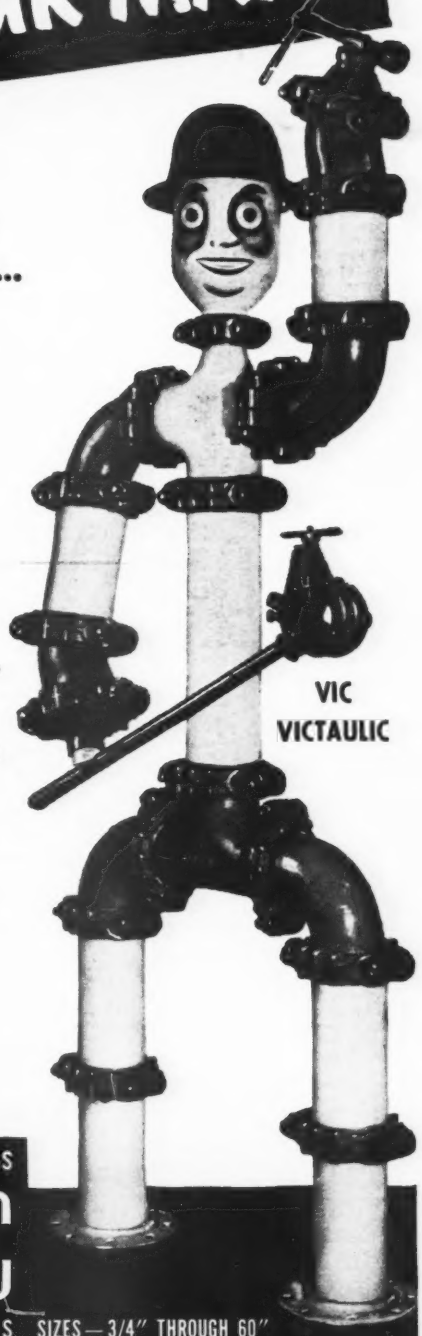
HIGHWAY NEEDS IN MICHIGAN—Prepared by the Highway Study Committee of the Michigan Good Roads Federation in cooperation with the Michigan State Highway Department, the Public Roads Administration and the Automotive Safety Foundation, Washington, D. C. Michigan Good Roads Federation, Lansing 7, Mich.

TECHNOLOGICAL STAGNATION IN GREAT BRITAIN—Machinery and Allied Products Institute, 120 South La Salle Street, Chicago, Ill. $0.25.

STRESSES IN A UNIFORMLY LOADED CIRCULAR-ARC-BEAM—Engineering Series No. 36—The University of Missouri Bulletin, Columbia, Mo.

INFLUENCE LINES FOR HORIZONTALLY CURVED FIXED-END BEAMS OF CIRCULAR-ARC PLAN—Engineering Series No. 35—The University of Missouri Bulletin, Columbia, Mo.

I'M YOUR MAN



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NOW LOOK AT the "Vic-Groover" in my right hand. It's a *new* tool that automatically grooves pipe ends exactly right . . . with twice the speed and half the effort of ordinary pipe threaders.

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CONSTRUCTION REPORTS

Proposed Work

Compiled by Business News Department—Engineering News-Record, 330 W. 42nd St., New York 18, N. Y.
ELSIE EAVES, Manager J. A. MAHONEY, Reports E. R. BIGGERSTAFF, M. R. ROESSLER, Statistics

WATER SUPPLY

PROPOSED WORK

Ark., Ft. Smith—City, WW exten. Over $500,000. W. R. Holway, 302 E. 18 St. Tulsa, Okla., consult. engr.

Calif., Manteca—City, City Hall, bond election $130,000, Apr. 13 to finance water sys. imprv. Over $50,000. L. B. Raab, cy. engr. CD 5/1/47—ENR 5/15/47.

Ind., Elkhart—Bd. P. Wks., Mayor Walter Larson, chn., City Hall, imprv. WW, incl. electrification of Main St., pumping plant, 2,000,000 gal. reservoir, 4 new wells, feeder mains. $325,000. Consoer, Townsend & Assoc., 351 E. Ohio St., Chicago, Ill., consult. engrs.

Ind., Marion—Bd. P. Wks., Mayor Willard Blackman, chn., City Hall, preliminary plans W. W. modernization, electrification of pump. plant, elevated steel storage tank. $150,000. Consoer, Townsend & Assoc., 351 E. Ohio St., Chicago, Ill., consult. engrs. CD 3/7—ENR 4/17.

Ind., Michigan City—Bd. P. Wks., Mayor Russell Hileman, chn., City Hall, W W imprvs. $100,000. Boyd E. Phelps, Inc., 232 Franklin St., constr. engr. Donald Ford, Michigan City, city engr.

Ind., Muncie—Bd. P. Wks., Mayor L. E. Holloway, chn., City Hall, W.W. sys. modernization, rehabilitation. $394,000. Ward Harlan, 414 Western Reserve Bldg., city engr.

Minn., Duluth—City, C. D. Jeronimus, clk., 5,000,000 gal. rein.-con. reservoir, with or without steel lining. $200,000. A. W. Tewes, Duluth, city engr.

N. C., Shelby — Town, Robert Van Sleen, Head Public Utilities, water plant. Over $200,000. J. N. Pease & Co., 119½ E. 5 St., Charlotte, consult. engrs.

Ore., Corvallis—City, City Hall, emergency pumping station incl. filtration and chlorination plan on Willamette River 3 mi. south of here. $391,234. Cornell, Howland, Hayes & Merryfield, Rennie Bldg., consult. engrs. V. L. Goodnight, city engr. CD 3/1/45—ENR 8/9/45.

Tex., RoBards (San Antonio P.O.) — Robards Twp., c/o Henry A. RoBards, Majestic Bldg., San Antonio, WW sys. $200,000.

Tex., Temple—City, Guy Draper, mayor, voted bonds, c. i. waterlines. Approx. $275,000. Julian Montgomery, Littlefield Bldg., Austin, consult. engr. CD 5/31/46—ENR 6/13/46.

B. C., Penticton—Municipality, Penticton, imprv. Penticton Creek W. W. sys. $100,000.

Ont., Beaverton—D Town, J. R. McMillan, clk., waterwork sys. About $130,000. G. A. Burns, Dpt. Health, Toronto, engr. CD 3/7/46—ENR 3/2/46.

Ont., Eastview (Ottawa) — Dpt. National Research, Sussex St., Ottawa, installing waterline at Montreal Rd. Research Laboratories. About $125,000. R. Blais, Dpt. P. Wks., Hunter Bldg., Ottawa, engrs.

Que., Three Rivers—City, G. Beaumier, clk., ratepayers to vote on referendum in April, watermains. $314,850. J. H. Valiquette, c/o owner, engr.

SEWERS, WASTE DISPOSAL

PROPOSED WORK

Ark., Conway — City, City Hall, sanitary sewer line to drain in Arkansas River. $245,000. M. L. Crist & Assoc., Gazette Bldg., Little Rock, consult. engrs. CD 3/1/46—ENR 3/21/46.

Calif., Pleasanton—City, City Hall, bonds voted Mar. 2, $126,000, for sewage disposal plant modernization. $120,000. R. E. Ramseier, 3813 Parker St., Berkeley, consult. engr. CD 2/3—ENR 2/19.

Calif., Riverbank — City, City Hall, bond election, $150,000, Apr. 13, sewerage disposal sys.

Calif., Yuba City—City, City Hall, bond election $550,000 Apr. 13, sewage disposal works. H. N. Jenks, 345 Madrono Ave., Palo Alto, consult. engr. G. Reed, city engr. CD 3/12/45—ENR 2/22/45.

Colo., Denver—Baker Metropolitan Sanitary Dist., Baker Addition, near Denver, sewerage and treatment, Baker Addition, near here. $553,000. Damon Runyan, 1023 Main St., Longmont, consult. engr. and archt.

Colo., Flagler—Town, plans completed sewerage and treatment plant. $103,000. Damon Runyan, 1023 Main St., Longmont, consult. engr. and archt. CD 3/13.

Colo., Monte Vista—Town, plans completed, sewerage. $178,000. Damon Runyan, 1023 Main St., Longmont, consult. engr. and archt.

Ind., Lafayette—Bd. P. Wks., City Hall, Dist. Sewer, North Lafayette, 5 mi. storm and sanitary sewers, 48 in. concrete main sewer, 6 in. laterals. $200,000. H. Chestnut, City Hall, city engr. CD 11/15/44—ENR 11/30/44.

Ind., Mitchell—Bd. P. Wks., Mitchell, sewerage sys. $150,000. Paul R. White, Muncie, consult. engr.

Ind., Richmond—Bd. P. Wks., Mayor L. D. Meadow, chn., City Hall, sewage treatment plant. $500,000. H. W. Steeg & Assoc., 809-129 E. Market St., Indianapolis, consult. engrs., S. W. Hodgin, Richmond, city engr. CD 3/2—ENR 3/18.

Kan., Kingman—City, $150,000 bond election Apr. 6, sewerage plant.

●**Md., Baltimore** — City, Bureau of Sewers, Municipal Bldg., sludge reduction plant at Back River Sewage treatment plant. $1,000,000. Whitman Requardt & Assoc., 1304 St. Paul St., engrs., Geo. E. Finck, 312 Municipal Bldg., sewage engr. CD 12/17/45 — ENR 12/27/45.

Minn., Windom—City, M. C. Langley, clk., sewage disposal plant. $100,000. Pfeifer & Shultz, 702 Wesley Temple Bldg., Minneapolis, consult. engrs.

●**Neb., Omaha**—City, bond election May 11, completing South Omaha Sewer, $1,185,000; sanitary sewers, $3,961,450. J. M. Garrison, city planning engr. CD 12/8—ENR 12/18.

Neb., Omaha — Loveland Imprv. Dist., 8005 Hickory St., sanitary sewers in suburban residental area. $150,000. Heinningson Engr. Co., Standard Oil Bldg., preliminary survey.

Neb., Wahoo—City, sewage plant. $100,000. Henningson Eng. Co., Standard Oil Bldg., Omaha, consult. engr.

N. M., Carlsbad—City, L. C. Garrett, mayor, bond election in April sanitary sewerage sys. $400,000. CD 1/16/46—ENR 2/7/46.

N. C., Concord—City, voted bonds, sanitary sewers. $250,000. CD 1/22—ENR 2/5.

Okla., Enid—City, defeated bonds Jan. 20, storm sewers. $205,000. C. C. Pate, Richards Bldg., Tulsa, consult. engr. CD 1/8.

Ore., Heppner—City, City Hall, sewerage sys. and disposal plant. $225,000. C. E. Stockman, Baker, consult. engr.

Ore., Nyssa—City, City Hall, sewerage sys., treatment plant. $200,000. C. E. Stockman, Baker, consult. engr.

R. I., Howard—State, Dpt. Health, State Office Bldg., Providence, sewage sys., trickle filter beds, to complete disposal plant. $200,000. Waterman Engr. Co., 86 Weybosset St., Providence, consult. engr. CD 10/15/48—ENR 10/21/43.

Tex., Huntsville—State Prison Bd. Austin, rehabilitation and expan. sanitary sewerage sys. for entire farm prison housing. $125,000.

Tex., Robards (San Antonio P.O.) — Robards Twp., c/o Henry A. Robards, Majestic Bldg., San Antonio, sanitary sewer sys. $275,000.

Tex., Temple — City, Guy Draper, mayor, voted bonds, sanitary sewer lines. Approx. $325,000. Julian Montgomery, Littlefield Bldg., Austin, consult. engr. CD 6/13/46—ENR 6/27/46.

Tex., Uvalde — City, J. R. Raine, mayor, sanitary sewer extens. $100,000. Alamo City Engineers, 3005 Transit Tower, San Antonio, consult. engrs. CD 8/22/45—ENR 9/6/45.

BRIDGES

PROPOSED WORK

Massachusetts — Commonwealth of Mass., Boston, bridge on Route 97 and 113, Groveland and Haverhill, Chap. 690, $600,000, substructure of bridge over Annisquam River, Gloucester, $800,000, both Essex Co.; bridge on Dorchester Ave, Route C-37, Boston, $300,000, bridge on Northampton, South St., Clark Ave. on Route C-37, Boston, Chap. 690, $150,000, both Suffolk Co.; bridge, upper Beaver, North Adams, Berkshire Co.; $110,000; bridge Reservoir Rd., Holden, Worcester Co., $50,000; bridge, Washington St., Taunton, Bristol, $60,000; Mass. Dpt. P. Wks., Bridge Cpt., Boston, engrs.

Mo., Carrollton—Carroll Co., J. B. Bittiker, clk., Court House, repairing or reconstructing 108 bridges damaged by floods. $100,000. Herman Slater, Carrollton, co. engr.

●**Pennsylvania**—State Hy. Dpt., Harrisburg, bridge to carry relocated Harrisburg-Lancaster Hy. over tracks of Reading Co. R. R. near Lancaster City and altering crossing on connecting roads over four tracks of Pennsylvania's R. R. main line, Lancaster Co. $627,000; grade crossing and approaches to carry relocated Harrisburg-Lancaster Hy. over tracks of Columbia Branch of Reading Co. R. R. north of Landisville, Lancaster Co., $340,000. E. L. Schmidt, c/o owner, engr.

Pennsylvania—State Hy. Dpt., Harrisburg, bridge to carry Reading R. R. tracks over Vine St., Philadelphia. $873,000. E. L. Schmidt, c/o owner, engr.

●**Tenn., Nashville**—City, City Hall, elevated Southern by-pass for through city traffic from 17 Ave. S. along Demonbreun St. to Sparkman St. bridge over Cumberland. $4,075,000. H. W. Lochner & Co., 150 N. Wacker St., Chicago, Ill., consult. engrs. W. A. Coolidge, city engr.

New Brunswick—Dpt. P. Wks., A. W. Barbour, deputy min., Fredericton, replacing highway bridge, Newcastle. Over $150,000.

STREETS AND ROADS

PROPOSED WORK

Colo., Julesburg — Town, plans completed, curb and gutters. $100,000. Damon Runyan, 1023 Main St., Longmont, consult. engr. and archt.

●**Connecticut** — State Hy. Dpt., State Office Bldg., 4 mi. rein.-con. hy. through North Meadows to Windsor, in Hartford and Windsor. $3,500,000. G. A. Hill, hy. engr.

●**Massachusetts** — Commonwealth of Mass., Boston, 1.74 mi. Route No. 128 R, Beverly, $1,250,000, 1.97 mi. on Route 128 R, Lynnfield-Wakefield, $1,230,000, 0.19 mi. on Bridge St. grade crossing elimination, Salem, $1,250,000 all foregoing in Essex Co.; 1.67 mi. on Route 3 R, Plymouth, $780,000, 1.35 mi. Route 3 R, Kingston, $660,000 both Plymouth Co.; 0.24 mi. Route 2 in Ayer, $264,000, 3.53 mi. Route 32, Petersham, $570,000, 1.0 mi. Route 140, Grafton, $60,000, all foregoing in Worchester Co.; 1.64 mi. Route 106, Easton and East Bridgewater, $190,000; 0.40 mi. Route 37, Braintree, $275,000; 0.44 mi. road in Montague, $500,000; 0.69 mi. Route 202, Belchertown, $120,000; 0.5 mi. Route 116 Chicopee, $211,000; 1.2 mi. Route 122, Orange; 1.16 mi. Route C-1, East Boston, Suffolk Co., $6,200,000; 1.2 mi. Route 37, Holbrook, $150,000; 0.7 mi. Route 116, South Hadley, $43,350 Mass. Dpt. P. Wks., Hy. Div., Boston, engrs.

Neb., Hartington — Cedar Co., Hartington bond election April 13, graveling county roads. $60,000.

Neb., Omaha — City, $450,000 bond election May 11, resurfacing major streets. J. M. Garrison, planning engr. CD 4/15—ENR 5/1.

Neb., Papillion—City, street imprvs. $115,000, Henningson Eng. Co., Standard Oil Bldg., Omaha, consult. engr. CD 12/11/46—ENR 12/26/46.

Okla., Bartlesville—City, 60 blocks of residence street paving. $300,000. V. G. Thompson, 1100 W. Main St., Oklahoma City, consult. engr.

Okla., Enid—City, defeated bonds Jan. 20, street widening. $400,000. C. C. Pate, Richards Bldg., Tulsa, consult. engr. CD 1/8.

Okla., Muskogee — City, bond election April 6, street repairs. $500,000. T. P. Clouts, Muskogee, consult. engr.

Tex., Robards (San Antonio P.O.) — Robards Twp., c/o Henry A. RoBards, Majectic Bldg., San Antonio, street constr and paving. $350,000.

Tex., Uvalde—City, J. R. Raine, mayor, seal coat existing streets, construct new city streets, concrete curbing, gutters, drainage. $125,000. Alamo City Engineers, 3005 Transit Tower, San Antonio, consult. engrs. CD 8/22/45—ENR 9/6/45.

Wash., Seattle — City, County-City Bldg., Zone 4, asphaltic concrete resurfacing E. Marginal Way. $126,000. J. Robertson, acting city engr.

Wash., Vancouver — Clark Co., Courthouse, grading 3.3 mi. road in Amboy vicinity. $130,000. S. C. Jayne, co. engr.

B. C., Penticton—Municipality, permanent surfacing roads. $200,000.

EARTHWORK, WATERWAYS

PROPOSED WORK

N. B., Campbellton — Dpt. P. Wks., Hunter Bldg., Ottawa, Ont., dredging in harbor. About $100,000. R. Blais, c/o owners, engr.

N. B., Petit Rocher—Dpt. P. Wks., Hunter Bldg., Ottawa, Ont., breakwater repairs. About $160,000. R. Blais, c/o owners, engr.

N. B., Stonehaven — Dpt. P. Wks., Hunter Bldg., Ottawa, Ont., breakwater, repairs. About $120,000. R. Blais, c/o owners, engr.

N. S., Neils Harbor—Dpt. P. Wks., Ottawa, Ont., repair breakwater. About $135,000. R. Blais, c/o owner, engr.